MOHENJO-DARO AND THE INDUS CIVILIZATION

MOHENJO-DARO AND THE INDUS CIVILIZATION

Being an official account of Archæological Excavations at Mohenjo-daro carried out by the Government of India between the years 1922 and 1927

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In three volumes, with plan and map in colours, and 164 plates in collotype

Volume II: Text. Chapters XX—XXXII
Appendices and Index

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41 GREAT RUSSELL STREET, LONDON, W.C. 1

1931

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ABBREVIATIONS

ASI.	*Archæological Survey of India.*
Arch. Mem. or *Mem. ASI.* .	*Memoirs of the Archæological Survey of India.*
ASR. . . .	*Annual Report of the Archæological Survey of India.*
ASWI.	*Archæological Survey of Western India.*
Ant. Journ. . . .	*Antiquaries Journal.*
BSA.	*British School at Athens.*
CAH.	*Cambridge Ancient History.*
CHI.	*Cambridge History of India.*
Ency. Britt. . . .	*Encyclopædia Britannica.*
ERE.	*Encyclopædia of Religions and Ethics.* Edited by J. Hastings.
Grund. d. indo-ar. Phil. .	*Grundriss der indo-arischen Philologie und Altertumskunde.*
IA.	*Indian Antiquary.*
ILN. . . .	*Illustrated London News.*
Imp. Gaz. . .	*Imperial Gazetteer of India.*
JA.	*Journal Asiatique.*
JAOS.	*Journal of the American Oriental Society.*
JASB.	*Journal of the Asiatic Society of Bengal.*
JBORS. . . .	*Journal of the Bihar and Orissa Research Society.*
Jour. Eg. Arch. . .	*Journal of Egyptian Archæology.*
JRAI.	*Journal of the Royal Anthropological Institute.*
JRAS.	*Journal of the Royal Asiatic Society.*
Mém. Dél. Perse . .	*Mémoires de la Délégation en Perse.*
Min. Mag. . . .	*Mineralogical Magazine.*
NH. or *Nat. Hist.* .	*Naturalis Historia.*
Obv.	Obverse.
OECT.	*Oxford editions of Cuneiform Texts.*
Palæo. Sin. . . .	*Palæontologia Sinica.*
Proc. A.S.B. . . .	*Proceedings of the Asiatic Society of Bengal.*
RA. or *Rev. Ass.* . .	*Revue d'Assyriologie.*
REC.	*Recherches sur l'origine de l'écriture Cunéiforme*, par Thureau-Dangin.
Rec. Ind. Mus. . .	*Records of the Indian Museum.*
Rev.	Reverse.
Rv.	Rigveda.
Zeit. für Ethn. . .	*Zeitschrift für Ethnologie.*

CHAPTER XX

FAIENCE AND STONE VESSELS

Faience Vessels (Pl. CI, 1–10 ; Pl. CLVII, 32 and 33 ; Pl. CLIX, 3 and 4)

FAIENCE ware is found in both the Intermediate and Late levels at Mohenjo-daro, and it will probably also be found in the Early levels when we get down to them. **Levels.**

Not many complete vessels of faience have been found at Mohenjo-daro, for this relatively soft material is easily broken or damaged by salt. Hence the scarcity of faience vessels does not prove that they were not in common use. All those found are of small size and very well made. It is probable that they were used for cosmetics ; indeed, a trace of a yellow substance is still to be seen in one of them (No. 8 in Pl. CI). None of them contained eye-paint, as anything of this nature invariably leaves traces behind. Judging from the comparatively large apertures of all these jars, the substances they once contained were fairly thick, and an unguent suggests itself as their probable content, though in few of them is the aperture large enough to allow of a finger being inserted. I would, therefore, suggest that some kind of powder was kept in these jars ; that it was costly is implied by the very small size of the jars. Indeed, Nos. 1, 3, and 8 are so small that they might almost be children's toys, were it not unlikely that children would be given playthings made of such a material as faience. **Reasons for scarcity.** **Suggested use.**

It will be noted that few of these faience jars have a substantial base ; they are mostly incapable of standing alone. On this account it is probable that they were kept in toilet boxes or other receptacles. **Bases.**

Several of these vessels still show traces of colour ; those illustrated in Pl. CI, 4, 8 and 10, are smoothly coated with a glaze of a light apple-green colour. The glaze of Nos. 3 and 9 is well preserved and still retains its original colour, turquoise-blue. The remaining jars have lost both colour and glaze. **Colour.**

There is a small hole in the side of the neck of No. 10 in Pl. CI to take a thread to fasten on a cover. No. 3 has two small holes, one on either side of the neck. The neck of No. 1 is grooved to take a cord for tying on the lid which is missing.[1] **Holes for covers.**

Some difficulty seems to have been experienced in making these jars ; their sides and especially their bases are remarkably thick. No. 8, for instance, would hardly contain anything at all, and Nos. 1 and 6 would hold but little. The makers were evidently uncertain of their material and feared to risk making the jars any thinner. **Manufacture.**

The paste of those jars which were broken and could consequently be properly examined was white or ash-grey in colour, and in most cases the glaze had penetrated well into it, both on the inside and outside of the jar. In the manufacture of the little jar, Pl. CI, 1, a certain amount of frit was mixed with the paste itself as well as being applied to it both inside and out. This process, which results in strengthening the articles so treated, has also been **Paste.**

[1] Possibly in this case the cover was made of cloth or leather.

noticed in other faience objects at Mohenjo-daro. This treatment, of course, requires considerably more heat than if the surfaces alone were glazed.

Not importations.

It is quite evident that these jars were not imported from outside India, and quite possibly they were actually of local make. Many of the shapes are copies of pottery ware, and in the list below I have made the necessary comparisons :—

Descriptions.

Plate CI, No. 1 (HR 994) is a beautifully made little vessel that was found 9 feet below the surface in the N.W. corner of House III, Block 2, Section A of the HR Area. It has a groove around its neck which obviously took the string which tied on the cover. In shape it resembles some of the storage jars; for instance, Nos. 1 and 2 in Pl. LXXXV.

No. 2 (SD 1705) seems to be a portion of a faience jar that was made in two pieces, the part preserved being the neck. On the other hand, it might equally have served the purpose of a jar-stand. It came from 8 feet below the surface of the ground in the lane between Blocks 4 and 5, Southern Buildings Section.

No. 3 (HR 5024) with its deeply scored middle is a passable imitation of the "B" type of pottery illustrated in Pl. LXXX. It was unearthed from 5 feet below the surface in Room 118, House XI, Block 2, HR Area.

Imitation of pottery forms.

No. 4 (SD 258) was made in two pieces and skilfully joined together at the junction of the shoulder and body. In shape it resembles the pottery jar No. 21 in Pl. LXXXI, but it has a wider aperture.

No. 5 (C 364) resembles a shape that was very commonly made in pottery, and so we are justified in restoring its upper portion as has been done (cf. Pl. LXXX, 9–27). Chamber 11, Block 12, Section C, DK Area, Level, 4 feet below the surface.

No. 6 (HR 5548) came from 4 feet below the surface in Room 65, House XXXI, Block 5, of the HR Area. It is evidently an imitation on a small scale of the large water-jars illustrated in Pl. LXXXV, 7 and 8.

Except for the beading around its base, No. 7 (E 387) is clearly duplicated by the pottery jar pictured in Pl. LXXX, 46.

No. 8 (DK 1933) is evidently copied from the pottery forms seen in Pl. LXXXI, 50–2. Found in the room north of No. 4, House XIV, Block 4, Section B, DK Area, 2 feet below surface.

No. 9 (SD 2390) was found at a level of 5 ft. below the surface in Chamber 15 of the Great Bath building; it is evidently a copy of some of the pottery illustrated as Type G in Pl. LXXX.

No. 10 (C 3063), like No. 4, was made in two pieces. In form it is quite unlike most of the pottery of Mohenjo-daro. The nearest approach to it is No. 7 in Pl. LXXXII. From Room 1, Block 6, Section C, DK Area. Level, 2 feet below surface.

Glazed pottery.

Pl. CLIX.—Nos. 1 and 2 in Pl. CLIX are two fragments of great technical interest; they are the only examples of glazed pottery that have as yet been found at Mohenjo-daro. For this reason they are reserved to and fully described in Chapter XXVIII on ivory, shell, faience, and other objects of technical interest.

Inlaid decorations.

No. 3 (HR 5843) in Pl. CLIX is also fully described in that chapter owing to its being exceptional in its make. It is but a fragment of a medium-sized jar, measuring 3 inches across. Its ground colour is a light-blue and the inlaid bands that decorate it are white. The composition of its paste is a powdery-looking material that has apparently been plentifully mixed with a coloured frit and then baked until vitrified. Found in House XXXII, Block 5, Section B, HR Area, at a depth of 2 ft. 6 in. below the surface.

Painted bands.

No. 4 (A 129) on the same plate was part of a jar about 2 inches high. It is of ordinary faience, now a light-blue colour and decorated with thin bands of purplish-black paint. These bands were painted with a frit that had been coloured with manganese,

and not fused properly, owing perhaps to the risk of the colour spreading and staining the surface of the jar. This fragment was found at a depth of 3 feet below the surface of the ground, in Room 13, Block 1, Section A, DK Area.

Stone Vessels (Pl. CI, 11–32, 34, and 35; Pl. CXXXI, 36 and 37)

Stone vessels not popular. Stone vessels are comparatively rare at Mohenjo-daro; only twenty-six in all have been found, most of which are in a fragmentary condition. This does not include Nos. 33 and 36 of Pl. CI, which are alabaster jar-stands.

Materials. All the vessels are of alabaster with the following exceptions: No 21, a dish of red stone that resembles sandstone; No. 24, brown limestone; No. 26, a greenish-grey slate; and No. 32, a dark-coloured limestone that is almost black. The two boxes illustrated in Pl. CXXXI, 36 and 37, are of steatite.

Alabaster. The soft white alabaster used to make these vessels is of very poor quality. It closely resembles Italian alabaster and is quite unlike the harder veined varieties that were used in early Sumer and Egypt.[1] Most of the vessels made of it have been badly damaged by salt. The frequent use of alabaster despite its poor quality was doubtless due to its being easily worked. This was a consideration when, as at Mohenjo-daro, the technique of making stone vessels was not of a very high standard.

Clumsy make. Most of the vessels are thick and clumsy-looking and it is evident that no particular care was taken in their manufacture. It is rather difficult to account for this fact, for that the inhabitants of Mohenjo-daro clearly understood the art of working hard stones, is proved by the excellent beads that they made.[2] One would have expected their stone vessels to have been as good.

Strainers. It appears that stone bowls were sometimes used as strainers, for a small portion of a dish was found perforated with holes, each 0·17 in. in diameter. This strainer must have been used for thicker liquids than water, for alabaster is to a certain extent soluble in the latter. Oil also penetrates this stone.

Details. *Plate CI*, 11–36.—It will be noticed that the smaller vessels, Nos. 11–16, are very clumsy and mostly only half-bored. Yet that they were finished specimens is proved by the polish of the outside. The little alabaster vessel (VS 2868), No. 11 in Pl. CI, was found in House XII of the VS Area at a depth of 2 feet below the surface of the ground; No. 12 (VS 2671), made in the same material, came from Chamber 76, House XIII, VS Area, and No. 14 (HR 2656), also of alabaster, from House IV, Block 2, Section A, of the HR Area. No. 15 (VS 2877) was unearthed in Chamber 76, House XIII, VS Area.

Tool used in boring. In No. 16 (HR 3729) part of the core was left adhering to the base inside, showing that it was bored with a tubular drill. This was the method employed in making all these stone vessels, and the softness of the material would allow of even a hard wooden drill, such as a piece of bamboo, being used, especially if wet sand were employed as an abrasive. This vessel, No. 16, was found in the room south of Chamber 43, House V, Block 2, HR Area, at a depth of 5 feet below the surface.

Feeding cup (?). No. 18 (HR 146), which resembles the pottery vessel in Pl. LXXXIII, 20, is of considerable interest.[3] It may be a portion of a spoon whose hollow handle is missing or, more likely, the missing portion was a hollow spout, though why a spout should be at the base of a vessel it is difficult to understand, unless this object is a feeding cup.

[1] Cf. p. 33 *supra*.

[2] Fragments of hard stone vessels have been found at Harappā.—[Ed.]

[3] Cf. a vessel in *Arch. Surv. Nubia*, 1910–11, pl. 25 (*c*).

No. 19 (HR 396), of alabaster, in shape is exactly like some of the pottery cups so common at Mohenjo-daro. Found in Court 13, House II, Block 2, Section A, of the HR Area, at a depth of 2 feet below the surface.

Red limestone dish.

No. 20 (VS 2304) is a badly weathered alabaster dish that was found at a depth of 13 feet below the surface in Room 28, House XXXI, VS Area. No. 21 is made of dark-red limestone, and, though thick and heavy, is better finished than the majority of the dishes. It came from Chamber 76, House XIII, of the VS Area, from a depth of 13 feet below the surface.

Two piece jars.

Nos. 22 and 30 (HR 1887), which were found in House II, Block 2, Section A, HR Area, at a level of 6 feet below the surface of the ground, formed the top of an alabaster jar that was made in more than one piece. The jar to which this neck and rim once belonged was probably globular in shape, and as it proved impossible to bore it satisfactorily through a very narrow neck, it had to be made in two portions. Vessels have been made from more than one piece of stone at all periods in the ancient East.

Brown limestone dish.

No. 23 (HR 5214) is a small alabaster vessel that was found in the space (92) east of House XXXIX, Block 5, of HR Area, where it was lying at a depth of 6 feet below the surface; and the small but heavy brown limestone dish, No. 24 (VS 2646), came from a level of 5 ft. 4 in. below the surface in House IX, VS Area.

Nos. 25 and 29 (HR 5780), which are both of alabaster, were found together in Room 54, House V, Block 2, of the HR Area, at a depth of 8 feet below the surface.

Slate.

No. 26 (HR 5212) is a dish of a greenish-grey slate ; it was unearthed in the open space (92), east of House XXXIX, Block 5, HR Area, where it was found at a depth of 6 feet below the surface.

No. 28 (HR 5985), of alabaster, comes from a depth of 8 feet below the surface of the ground in Room 87, House IX, Block 2, HR Area.

No. 31 (SD 2552) was in a very fragmentary condition, but enough remained to allow of its shape being drawn. It was found in the Great Bath Section, at a level of 18 inches below the surface.

Dark limestone.

No. 32 (VS 2941) is a dark-brown, almost black limestone and, though thick and heavy, is carefully made and has a semi-polished surface. It was found in two pieces, at a depth of 5 ft. 6 in. in Chamber 76, House XIII, VS Area.

Jar-stand.

No. 33 (VS 2939) is an alabaster jar-stand that was broken into two pieces. It was unearthed from a depth of 5 ft. 6 in. in the same chamber as No. 32. Another jar-stand, No. 36 (HR 4944), which is also made of alabaster, came from a depth of 6 feet in Room 37, south of House VI, Block 2, in the HR Area.

Nos. 34 and 35 (DK 2798) are shallow dishes of alabaster, which were found together in the DK Area. Both were badly broken, but enough remained of each to draw them. Room 3, Block 1, Section B, DK Area. Level, 3 feet below surface.

Little variety in shape.

There is but little difference in the shapes of the dishes found at the various levels. For instance, No. 20, found 13 feet below the surface of the ground is just as poor in workmanship and as simple in design as No. 28, which was 8 feet down, and No. 31, which was only 1 ft. 6 in. below the surface.

Adoption of pottery forms.

It will be seen that some of these stone vessels resemble certain pottery vessels in shape. For instance, Nos. 14 and 17 very closely resemble the goblets seen in Pl. LXXXI, 50–2 ; like them they have solid bases. The resemblance between No. 18 and the feeding-cup (?) seen in Pl. LXXXIII, 20, has already been noted. No. 23 is obviously a copy of a type of pottery vessel which is found in hundreds at Mohenjo-daro (Pl. LXXX, 10). The badly broken alabaster vessel, No. 27, has a base exactly similar to that of the pottery jar illustrated

in Pl. LXXX, 29, and as there is every reason to think that its upper portion was similar in shape, it has been so restored. Yet none of the stone dishes closely resemble the pottery ones, and we have yet to find examples of the latter with rounded bases. These round-based stone dishes must have been kept on stands of some kind, otherwise they would have spun on hard brick floors.

Rivet repairs. No. 35, of which only two very weathered fragments remain, was broken anciently and repaired with rivets ; there are rivet holes in both pieces. This method of repairing stone vessels was also practised in ancient Egypt in the earliest times and in Mesopotamia in pre-Sargonic days. In the latter country, copper, lead, and silver wire were used for riveting, but there are no indications on our pieces of what metal was employed.[1] It is evident that these dishes, though made of inferior stone, were greatly prized at Mohenjo-daro ; otherwise no attempt would have been made to repair them.

Grinders. The interiors of the dishes appear to have been hollowed out by means of a hard stone grinder, such as that illustrated in Pl. CXXX, 35. At first sight this grinder appears to be a kind of battle-axe, but one side is slightly concave and the other convex, and the two edge-like ends are rounded. A forked stick was probably used to grip this tool, which was rotated by means of another stick at right angles at its upper end. A very similar method was adopted in making the harder stone dishes of early times in Egypt, emery or very fine sand being used as an abrasive.[2]

Stone boxes. *Plate CXXXI*, 36 *and* 37.—The first (VS 2881) of the two vessels illustrated in Pl. CXXXI, 36 and 37, is a badly broken box, 2·5 inches high, with undecorated sides 0·25 in. thick. It had four compartments, of which the only intact one measures 1·5 by 1·6 inches. There is a slight rebate at the edge to take a cover, which was tied on by a cord carried through a small horizontal hole bored diagonally through the corner of the box. This box was found 7 feet below the surface in Chamber 76, House XIII, of the VS Area.

Incised decoration. No. 37 (VS 2505) is a better preserved box of four compartments, each of which measures 1·4 by 1·5 inches at the base. The partitions between the compartments are 0·3 inches thick at the base and thin out to 0·1 at the top. When complete, this box must have measured 3·8 inches square by 2·45 inches high. The rim is rebated to take a cover, and a small horizontal hole runs diagonally through each corner at a depth of 0·4 in below the rim. The sides and remaining end of the box are divided into two registers by a thin border of two parallel lines with vertical lines between. Each register is decorated with an incised motif of triangles set one inside the other. Though there is no trace of a white filling in any of the incisions, there is reason to think that it originally existed, for the box which was probably used for cosmetics, appears to be an imitation of the black, incised ware of Sumer and other places, in which the designs were inset with gypsum or a similar white material. Indeed, this box might easily be taken for Sumerian work in shape as well as decoration.[3] Level, 5 feet below surface. Room 76, House XIII, VS Area.

[1] It may also have been leather or some sort of fibre.

[2] Cf. a similar object illustrated in Petrie, *Tools and Weapons*, pl. lii, fig. 73.

[3] It may quite well have been an importation ; its decoration suggests Sumerian work.

CHAPTER XXI

SEALS AND SEAL IMPRESSIONS, COPPER TABLETS, AND TABULATION

THE seals and fragments of seals found in such remarkably large numbers at various levels at Mohenjo-daro are perhaps the most interesting of all the objects that have been unearthed there.

Number of seals. Up to date,[1] 558 specimens have been recovered, the majority of which bear one, and sometimes two, lines of pictographs in addition to the representation of an animal. In this chapter, I purpose only to deal with the technical aspect of these seals, leaving to others the interpretation of the signs engraved upon them. And first let me remark that the illustrations of the seals reproduced in Plates CII to CXV are photographs of impressions on wax of the actual seals. It should, therefore, be borne in mind that these illustrations are the reverse of the seals themselves. Thus an animal that faces to the left on the actual seal faces to the right on the seal impression. In other words, the seals are shown as they would appear stamped on a bale of merchandise or on the sealing of a jar. In speaking, therefore, of the direction in which an animal is facing, it is to the impression of the seal and not to the actual seal itself that reference is made. Most of the seals in the illustrations have been photographed to natural size.

First discovery. Seals of this type were first published by Sir Alexander Cunningham, who secured several specimens of them from villagers in the neighbourhood of Harappā in the Montgomery District of the Panjāb.[2]

TYPES OF SEALS

Types of seals. The seals of Mohenjo-daro can be conveniently classified in ten different groups :—

(*a*) Cylinder seals (?).

(*b*) Square seals with perforated boss on reverse.

(*c*) Square seals with no boss and frequently inscribed on both sides.

(*d*) Rectangular seals without boss.

(*e*) Button seals with linear designs.

[1] May, 1927.

[2] Cunningham's *Archæol. Reports*, vol. v (1875), p. 108; pl. xxxiii, fig. 1. A short note on these particular seals by the late J. F. Fleet appears in the *JRAS* for 1912.

According to Professor Sayce, a seal from Harappā, now in the possession of the British Museum, was published many years ago by Terrien de Lacouperie in the *Proceedings of the Society of Biblical Archæology*. See *Antiquity*, June, 1927, p. 206, note.

(*f*) Rectangular seals with perforated convex back.

(*g*) Cube seals.

(*h*) Round seals with perforated boss.

(*i*) Rectangular seals with perforated boss.

(*j*) Round seals with no boss and inscribed on both sides.

(*a*) *Cylinder Seals* (?) (Pl. CXIV, 529–33)

Cylinder seals. Seals of this group, if indeed they are seals, are very rarely found at Mohenjo-daro, only five specimens being obtained in all. They are all made of ivory and differ from the cylinder seals of other countries in being very long and thin ; nor are they perforated for suspension on a cord. It is possible that these so-called seals are not true seals at all. The incised characters upon them might conceivably be identification marks for a game or something similar. On the other hand, they are certainly suitable for use as seals and on this account they are included in this chapter. For the sake of clearness the actual seal is shown side by side with each impression.

Details. No. 529 (Pl. CXIV, HR 5515). Ivory. 2·7 inches long by 0·25 in. in diameter. Double groove at one end for attachment of cord. The other end is decorated with three parallel grooves. Level, 4 feet below surface. Central Courtyard (30), House LIII, Block 7, HR Area.

No. 530 (Pl. CXIV, HR 4985). Ivory. 2·05 inches long by 0·25 in. in diameter. Double-groove at one end for a cord ; the other end is broken. Level, 3 feet below surface.

No. 531 (Pl. CXIV, DK 2666). Ivory. Now 2·05 inches long by 0·3 in. in diameter. Its polish shows that it has been much used. About one-half of the seal is covered with an inscription, deeply and roughly incised and bordered by two deeply cut lines. One end of the seal is shaped into a conical head with a deep groove possibly intended for a cord. The seal is not bored ; nor is it perfectly round. Level, 4 feet below surface. Street between Blocks 1 and 2, Section B, DK Area.

No. 532 (Pl. CXIV, VS 875). Ivory. Now 2 inches long by 0·3 in. in diameter. One end is broken and a small piece is missing. The seal tapers slightly towards its complete end. Five deeply incised characters occupy a space of about two-thirds of the circumference of the seal. Level, 12 feet below surface. Found in front of Room 70, House XXVII, VS Area.

No. 533 (VS 958). Ivory. 2·75 in. long by 0·3 in. in diameter. Decorated at 0·5 in. from each end with a deeply incised cross-hatched border. Towards one end of the intervening space are two deeply incised characters. This seal is not perfectly round. Level, 10 feet below surface of ground. From Room 69, House XXVII, VS Area.

Reed-like shape. It will be noticed that there is a considerable variation in the levels below ground at which the above specimens were found, and that, therefore, they cannot be relegated to one and the same period. In shape they closely approximate to what is supposed to have been the origin of the cylinder seals of other countries, namely, a short piece of reed or cane. But it is not suggested that cylinder seals originated in Sind.

The ends of three of the seals are knob-like, which certainly supports the idea that they were once tied to a cord.

(*b*) *Square Seals with Perforated Boss on Reverse* (Pl. CII, *a*, *b*, and *c*)

Seals of this type appear to be always made of steatite, and they have been found in such numbers that it is impossible to deal with them individually, beyond mentioning those that are in some way peculiar. Typical seals of this group bear a representation of an animal with one or more lines of pictographs along the top. They are nearly always perfectly square and vary considerably in size. The following list of the sizes of 328 perfect specimens is given for the use of those interested in metrology :—

Inches.	*Examples.*	*Inches.*	*Examples.*
0·5 × 0·5	5	0·55 × 0·55	6
0·6 × 0·6	9	0·65 × 0·65	8
0·7 × 0·7	20	0·75 × 0·75	14
0·8 × 0·8	16	0·85 × 0·85	23
0·9 × 0·9	18	0·95 × 0·95	16
1·0 × 1·0	22	1·05 × 1·05	20
1·1 × 1·1	28	1·15 × 1·15	17
1·2 × 1·2	23	1·25 × 1·25	9
1·3 × 1·3	15	1·35 × 1·35	10
1·4 × 1·4	14	1·45 × 1·45	4
1·5 × 1·5	5	1·55 × 1·55	3
1·6 × 1·6	4	1·65 × 1·65	1
1·7 × 1·7	1	1·75 × 1·75	1
1·8 × 1·8	3	1·85 × 1·85	5
1·9 × 1·9	1	1·95 × 1·95	Nil.
2·0 × 2·0	2	2·05 × 2·05	Nil.
2·1 × 2·1	1	2·15 × 2·15	Nil.
2·2 × 2·2	Nil.	2·25 × 2·25	1
2·3 × 2·3	Nil.	2·35 × 2·35	1
2·4 × 2·4	Nil.	2·45 × 2·45	Nil
2·5 × 2·5	1	2·55 × 2·55	Nil.
2·6 × 2·6	Nil.	2·7 × 2·7	1

Most favoured sizes.

From the above figures it is clear that the favourite size for seals of this type was 1·1 by 1·1 inches, followed fairly closely by seals measuring 0·85 by 0·85 in. and 1·2 by 1·2 inches. Seals of very large size were not popular, none being found above 2·7 by 2·7 inches.[1] Parenthetically, it may be observed that after these seals had been cut to a definite size, subsequent trimming and polish would reduce their sizes considerably.

The thickness of the seals was not measured, as it was found to vary greatly in seals from the same area. The average thickness of a seal measuring 0·5 by 0·5 in. was 0·2 in.; and of a seal 2·6 by 2·6 inches square, it was 0·75 in. These thicknesses do not include the boss at the back.

(*c*) *Square Seals with no Boss and frequently Inscribed on both Sides* (Pl. CII, *n*, *o*, and *p*)

Altogether twelve seals of this type were found, all except five (C 2631 ; E 904 ; HR 2739 ; HR 2240 ; HR 4264) being pierced with a small hole to take a cord. Nine are of fine white steatite, one of black steatite and two of pottery, a very unusual material. Of the last two, one (HR 4264) is not cut, but moulded from the impression of another seal.

[1] Seals of equal weight but of a different shape were carried on the wrist in Mesopotamia.

Seals of this type vary in size from 1·1 inches square and 0·5 in. thick down to 0·55 in. square and 0·3 in. thick. The majority are well made with clean sharp edges.

Inscribed on both faces. Four of these seals are inscribed on both their faces (E 904; HR 2739; HR 2596; HR 4503). Two are inscribed on two of their sides as well as on their two faces (L 323; HR 2240). On one of these (L 323), there is a unicorn on both faces, but not the same inscription. A very curious figure is cut on two of the sides, which may possibly represent the Sumerian hero Enkidu. On another seal (HR 2596), one side bears the representation of a fabulous animal and the other a unicorn. The inscription, consisting of two characters, is the same on both sides of this seal. There is a short-horned bull on one side of HR 4503 and a *svastika* on the reverse. HR 2240 has an inscription on each face, and also pictographs on two of the sides.

HR 2739 is very thin for its size, measuring 1 inch square and only 0·15 in. thick. On one side there is a *svastika* and on the other an involved design of triangles. It is in a much-weathered condition, and for that reason no impression could be taken of it.

Type not popular. It is somewhat surprising that seals of this type were not more popular. They are convenient in size and shape, and lack the ugly boss at the back. For the latter reason, they were made of a convenient thickness to hold with the fingers. Two of them, however, differ from the rest in being exceptionally thin, viz. about 0·12 in. in thickness. Some little difficulty must certainly have been experienced in holding these two seals to make their impressions.

The average diameter of the hole in those that were pierced is 0·1 in. In every case, even in the smallest specimens, the hole was bored from both sides of the seal. The edges of the holes show little or no evidence of wear (Nos. 120, 311, 356, 378, 471, 472, 475–7).

(*d*) *Rectangular Seals with no Boss*

Rare type. Of this type of seal only six examples have been found. Five are made of steatite (A 148; E 2039; HR 3732; HR 5248; and VS 208), two yellow, one grey, one black, and one white. The sixth (HR 1695) is made of faience. They are all simple blocks of rectangular shape, and with one exception perforated by a small hole that was bored from both sides of the seal. All six bear plain inscriptions, without any animal devices. Only two are inscribed on both sides (A 148 and E 2039), and on none of the seals are the sides or ends inscribed (Plate CXIII, Nos. 412, 413, 435, 440, 441, 442, 459).

(*e*) *Button Seals with Linear Designs*

Pintaderas (?) Altogether, twenty-two examples were found of this variety of seal, twenty of which are illustrated in Pl. CXIV. All are square, thin, and provided with a shallow perforated boss at the back. Five of these seals are of steatite (B 650; C 2927; HR 2728; HR 6207; Mus. 8). The remainder are of faience, which in every case is colourless. The paste itself varies in colour from white to light-yellow. The button seals that were made of faience were all moulded and vary so little that it is hard to believe that they were used actually as seals, which necessarily require a measure of individuality. They may have served to stamp impressions for some religious purpose, like the caste-marks of to-day.[1]

The seals of this group range in size from 0·5 to 0·95 in. square. The boss at the back is in most cases a mere loop. It is best finished in the seals made of stone, where the boss is divided into two by a shallow groove, as in the seals of Type *b*.

[1] In a similar manner to the *pintaderas* used in Danubian II, Thracian copper age, and early Greece, etc.

Svastika.

The design most frequently found on seals of this description is the *svastika* (Nos. 500–515). This symbol was known in most parts of the ancient world, and it is quite impossible to determine the country of its origin. It is found in Crete[1] and Cappadocia,[2] and was common at Troy, where it appears among the motifs with which spinning whorls were decorated. It occurs on pottery from Susa and Musyān[3] in its simple form as well as in its derivatives.[4] For some reason, not yet explained, it is not known in Babylonia,[5] neither does it occur in Egypt. In India at the present day, both name and symbol are emblems of good luck.

Arms of svastika.

It will be noticed that the arms of the *svastika* turn sometimes one way, sometimes the other. In historic India the direction of the arms has generally been towards the right, for the symbol was considered unlucky if the arms were turned towards the left. That no such feeling existed at Mohenjo-daro seems evident from the impartiality with which the arms were turned in either direction, though a clockwise direction is, if anything, less common than the reverse.[6]

Design of squares.

The seal illustrated as No. 516, which bears a design consisting of a number of squares set inside the other, is the only one of its kind found at Mohenjo-daro. It is known, however, at Susa and dated there to the proto-Elamite period.[7] The designs on seals Nos. 536 and 537 are also unusual, though of a very simple nature.

The motif in Nos. 520 and 521 is again very rarely found. It appears to be a simple adaptation of the stepped triangle motif that is so common on the pottery from Nāl, a design which is also known in some of the shell-inlay found at Mohenjo-daro (Pl. CLV, 33) and on a cylinder seal from Susa.[8]

The design shown in No. 522 appears to be made up of two parallel lines enclosed in a square and linked up in the middle by rough scratches.

Unfortunately, the largest seal of this type (HR 6006) was too defaced to be photographed.

There is a very similar motif to that of seal No. 528*b* on a jar belonging to the First Period of Susa,[9] but this motif is rare at both Susa and Musyān.

(*f*) *Rectangular Seals with Perforated Convex Back* (Pl. CII, *d*, *e*, and *f*)

Of this type of seal there are sixty-four examples, ranging in size from 0·6 in. to 2·2 inches long. Most of the specimens are of white steatite, but there are eleven seals of black steatite, three grey (C 1878; D 114; HR 1050), and one yellow steatite (HR 6210).

[1] A very complex form of the *svastika* appears on an ivory seal from Hagia Triada, dated to the E.M. III Period. See Evans, *Palace of Minos*, vol. i, p. 121, fig. 90*a*. In the same period it appears on seals in a simple form with curved arms. Later on in the M.M. I Period it is found on pottery, first with the arms curved, then with straight arms. *Ibid.*, vol. i, pp. 185, 515, 640; vol. ii, pt. i, p. 197.

[2] *Catalogue des cylindres orient., Musée du Louvre*, vol. ii, pl. 98, fig. 12 *b*; Frankfort, *Studies in Early Pottery of the Near East*, ii, pl. ix, fig. 2; p. 164, fig. *a*.

[3] *Mém. Dél. en Perse*, t. viii, p. 110, fig. 176; t. xiii, pl. xli, fig. 3. Delaporte, *Cat. cyl. orient.*, t. i, pl. 17, fig. 1.

[4] *Mém. Dél. en Perse*, t. xiii, p. 71, fig. 193.

[5] See, however, Herzfeld, *Die Ausgrabungen von Samarra*, 5, pp. 13, 16, 17, etc.

[6] For convenient illustrations see de Morgan, *La Préhistoire orientale*, t. ii, p. 266, fig. 293. The potter of Elam seems to have drawn the arms of the *svastika* clockwise or counter-clockwise indifferently.

[7] *Mém. Dél. en Perse*, t. xvi, pl. i, fig. 8. The same motif, but on painted pottery, has been found by Sir Aurel Stein in northern Balūchistān. *Mem. Archl. Surv. of India*, No. 37, pl. xv.

[8] *Catalogue des cylindres orient., Musée du Louvre*, t. i, pl. xvi, fig. 10

[9] *Mém. Dél. en Perse*, t. xiii, pl. xxi, fig. 4

Pottery seals.

Three pottery seals of this type (C 656; HR 116; and HR 6187) are of particular interest, inasmuch as pottery seals of any type are comparatively rare at Mohenjo-daro. Two are somewhat roughly made with rounded backs instead of the flat back and bevelled ends that are usual in this type. The third example (HR 6187) is better made; it is smoothly coated with a polished red slip. The inscriptions on these three seals were cut before the seals were baked. On the best finished specimen the cutting is exceptionally well done, the characters being very even and clear (seal 402). And this seal has a hole through its width for a cord, whereas the other two are not perforated. All the steatite seals have a hole, which was bored from both sides for threading on a cord.

The seals of this type bear inscriptions only, some of which are exceptionally well cut. No pictographs ever appear on the sides or backs of these seals.

(*g*) *Cube Seals*

Yellow paste.

Only five examples of this type of seal have been found at Mohenjo-daro, averaging in size 0·7 in. each way. They are all roughly made of a sandy-yellow paste, which appears to have once been glazed. Evidently but little care was taken in their manufacture. On four of these seals sets of parallel lines crossing one another have been roughly scratched on two opposite sides. On the fifth seal the same motif occurs, but on one side only, the opposite side being slightly rounded as if to be held between the fingers. The remaining sides of three of the seals bear representations of the unicorn in relief, apparently impressed by a small seal of the usual type. The pictographs above the animals on all these seals are too weathered to be legible.

Hatching.

The fact that some of the sides bear seal impressions, whereas the other sides might serve as actual seals, makes it difficult to say what these specimens really are. A series of parallel lines crossing one another at various angles was a favourite design in the ancient world for the less elaborate types of seals. Examples have been found at Kish and at Jemdet Nasr, in Mesopotamia, and the motif is well known at Susa,[1] where it has been found on seal impressions in clay. It is known, too, on a rough steatite seal from Cappodocia,[2] and the design occurs on some early seals from Crete and Egypt.[3]

One might be tempted to think that a uniform design of this sort would be useless for the purpose of a seal; as a fact, however, it is extremely effective, since the irregularity of the lines makes it almost impossible to forge. It had this added advantage, moreover, that the very poor could make such seals for themselves and thus avoid resorting to an expensive seal-cutter. (See Pl. CXIV, 523, 524, 525, 526, 528.)

(*h*) *Round Seals with Perforated Boss* (Pl. CII, *k*, *l*, and *m*)

Resemblance to seal from Telloh.

Only three of these seals have been found (E 1886; HR 4393; and VS 3027). They are all well made with flat base and top; and the boss in the centre of the former is partially subdivided by a groove across the middle and is perforated with a hole averaging 0·1 in. in diameter. Unfortunately, two of these seals are broken and all show signs of a considerable amount of wear; their edges are rubbed and slightly rounded. The edges of all three were originally slightly bevelled, a feature that is especially noticeable in HR 4393. The

[1] *Mém. Dél. en Perse*, t. xvi, pl. i, fig. 1.

[2] *Catalogue des cylindres orient., Musée du Louvre*, vol. i, pl. xxxviii, fig. 6; vol. ii, pl. xcviii, fig. 6*b*. Also Legrain, *Culture of the Babylonians*, pl. i, fig. 4.

[3] Hall, *The Civilization of Greece in the Bronze Age*, pp. 70, 71, figs. 73 and 75.

designs on these seals are illustrated in Nos. 309, 383, and 478. A seal of exactly the same type as those just described was found by de Sarzec at Telloh in Mesopotamia. It very closely resembles No. 309, and is described [1] as being made of a soft, greenish-grey stone, probably steatite.

(*i*) *Rectangular Seals with Perforated Boss*

Rare type. Only one seal (VS 2846) of this type was found. It is of steatite and measures 0·9 by 0·7 in. The inscription upon it, of three characters only, is illustrated in No. 460. Though well made and finished, this steatite seal looks as if it had been cut down from a larger one since it is unduly thin for its size. The boss, however, is exceptionally well finished, which is not usually the case with seals that have been cut down.

(*j*) *Round Seals with no Boss and Inscribed on both Sides*

Tree. Seal E 1908, which is badly broken, is made of calcite and measures 0·75 in. in diameter and 0·15 in. thick. Both sides are deeply incised. On one side are characters arranged in three registers ; on the other side is the representation of a large tree, a very unusual motif for a seal. This seal has no boss to hold it by, nor has it a hole. If it was actually used as a seal, it must have been difficult to hold because of its thinness. Both sides of this seal are illustrated (No. 527).

Seals of Unusual Character

Such of the seals from Mohenjo-daro as exhibit exceptional features are described *seriatim* below.

Top edge lowered. Seal 9 (C 1895). Type B. The inscription at the top of this seal has been entirely removed by sawing off a piece 0·3 in. deep by 0·5 in. wide. As the seal is badly broken, though it shows signs of but little wear, the possibility must not be lost sight of that it had been discarded and was being cut up for its material. It is possible also that a new piece of stone was inserted to take another inscription.

Inscribed boss. Seal 18 (HR 5804). Type B. A part of the boss of this seal has been split away ; and on the remaining portion that was roughly smoothed down, a single character, like the third sign on No. 463, was cut.

Seal 304 (L 385), which has no inscription, has had its corner sawn away. Perhaps this seal was discarded and a piece taken from it to serve some other purpose.

Bevelled edges. Seals 335 (HR 2657) and 337 (B 588). Type B. In No. 335 the two edges in front and behind the animal were bevelled.[2] In No. 337 the edge in front of the animal only is bevelled. This bevelling was possibly due to the stone being faulty and splitting when the seal was engraved, or a mistake made in the cutting of the device was rectified by lowering the ground. Whatever the reason may have been, both seals give perfectly good impressions.

Two registers. Seal 376 (HR 4212*e*), type B, has two registers. A fabulous animal with an elephant's trunk occupies the upper, and an elephant the lower division.

[1] *Catalogue des cylindres orient., Musée du Louvre*, vol. i, pl. ii, figs. 8*a* and 8*b*. The same seal is published in L. Heuzey, *Découvertes en Chaldée*, pl. xxx, fig. 3*a*.

[2] This is quite apparent, though the greater part of the front edge is missing.

Seal 389 (D 171). Type B. The peculiarity of this seal lies in there being no representation of an animal upon it. The same remark also applies to seal 395 (VS 1190).

Triple row of pictographs. Seal 396 (HR 5676) and Seal 400 (HR 3005). Type B. These two seals are unusual in that their faces are entirely filled up with three rows of pictographs ; the animal figure that is a regular feature on seals of this type is omitted.

Seal 394 (C 3158). Type B. The face of this seal is divided into two equal portions by a thin incised line, on one side of which are two characters, while the other half of the seal has been left blank.

VS 3480, which is not illustrated, is an unfinished seal of type B without any engraving; it measures 0·8 in. square. Such unfinished seals are very rare.

A few of the seals, besides having devices and inscriptions on one or both faces, also have, as already stated, either figures or signs engraved on one or more of their sides.

Mythological figure. Seal L 323, whose two faces are seen in Nos. 227 and 230, has the figure of a man with bull's horns, legs, and tail, on two sides. These figures are identical and are illustrated in No. 356. As suggested above, they may represent the Sumerian hero, Enkidu.

Two fragmentary seals (271 and 293) have a single pictograph on the upper edge. The fine seal figured in No. 325 also has an inscription along its upper edge, as shown in the illustration.

Nos. 471, 472, and 473 are illustrations of different faces of the same seal. The first two are impressions of the obverse and reverse ; the last shows two of the sides. The upper and lower edges of the seal are blank.

The seal whose obverse and reverse are illustrated in Nos. 252 and 378, is especially interesting in that the same inscription occurs on both faces above animal devices which are entirely different.

Comb motif. It will be remembered that the comb motif appears on the painted pottery of both Mohenjo-daro and Elam, and on Hittite ware. It also seems to figure amongst the characters on the seals, e.g. Nos. 142, 161, 329, and 413.

Method of Manufacture

Use of saw. The stone seals were first cut into shape by means of a saw, the marks of which are clearly seen on unfinished seals or those that have been altered. The average thickness of the saws used in this process was 0·025 in. After the seal had been cut to the size required, if it was to have a boss, this was roughly cut into shape with the saw ; a horizontal cut was made from each side of the seal towards the centre and four vertical cuts were then made downwards to meet the horizontal ones. A rough square projection, the size of the boss, was thus left at the back of the seal. The boss was then carefully rounded off after the groove that always runs across its centre had been roughly made by a V-shaped cut. The rounding of the boss was apparently done with a knife and finished off with an abrasive, after which a hole was bored through it from opposite sides to take a cord. The hole for the cord was sometimes bored horizontally, but more generally it dips slightly from the two ends towards the centre. As steatite has a tendency to split along the cleavage planes, the probable idea of these converging holes, which are too common to be accidental, was probably to carry the hole into the substance of the seal itself rather than to rely solely on the boss, which owing to its prominence and the nature of the stone was always liable to be knocked off. Indeed, this actually happened to many of the seals and was remedied by cutting fresh bosses with a consequent thinning of the seal.

Repairs.

Such an accident happened to seal L 384 (No. 382), which was apparently repaired by the owner himself; he cut another boss very roughly with a saw, but did not take the trouble to round it off or even to remove the saw-marks.

From the evidence afforded us by seal L 351 (No. 307), it would seem that in some cases, at all events, the device and characters on the seal were cut either before the preliminary shaping of the boss or before it was rounded off and finished. This seems a sensible procedure, for if a seal were damaged in the engraving or a mistake made, not much work would be wasted. The seal in question also seems to have been the work of an inexperienced engraver, for the cutting is very shallow and roughly done.

Bosses.

As a general rule, the bosses on the seals occupy about a third of the area of the back of the seal, and but for the grooves down the centre of each, which give them an appearance of being double, they are hemispherical in shape. In rare cases, however, the boss is very much smaller in proportion to the size of the seal, and in seal L 386 (No. 341) it is elongated and slightly concave, with a slight raised beading at each end.

Use of burin.

The designs appear to have been cut with a burin, and in the majority of seals the work is cleanly done, even curved lines, such as those needed for the horns of animals, being cut without the slightest trace of hesitation. Though carefully looked for, there is no evidence that a drill was first used for outlining the figures—a common feature of the archaic seals of Elam and Sumer. But both pointed and hollow drills were used to put in details, e.g., the roughnesses of the hide of the rhinoceros, the ornamentation of the cult-object in front of the so-called unicorn, and the spots on the fabulous animal in No. 385. In no case did the seal-cutter use the drill to portray the eyes of any of the animals, with the sole exception of the fabulous creature above mentioned.

Method of carving.

No. 256 is a good example of a seal that has been left unfinished. In this case we know that the seal itself was finished before the engraving was started, for the boss is complete and perforated, and even polished.[1] In engraving the seal, the artist started his work in a somewhat curious way. Instead of first outlining the whole figure of the animal and then cutting deeper, he started on the body and apparently completed it before outlining the other parts. Even the trappings over the withers of the animal are finished, a detail that one would have expected to be left to the last. It is clear that the engraver was so familiar with his work that he could start on and complete any part of an animal without having the whole outline before him.

It is, of course, possible that the outlines of the animal were first drawn with paint or ink; the seal, however, shows no evidence of this, though on a damp site like Mohenjo-daro it is unlikely that any paint or ink would remain.

Inscriptions added later.

The crookedness of some of the characters in the inscriptions suggests that they were added later. This seems the more probable, as owing to the great variety of these inscriptions, they can hardly refer to the animal below. When, if ever, these inscriptions are deciphered, we shall probably find them to be personal names, perhaps coupled with titles or occupations. The seal-cutters probably kept a stock of seals by them and added the inscriptions as required.

Cramping of characters.

The inscriptions as a rule are neatly arranged in a single line along the top of the seal. If there was not sufficient room, a second line was added, and sometimes the characters of this second line, owing to lack of space, are smaller than those in the line above (Nos. 101, 139, 237, 253, etc.). Occasionally—also on account of lack of room—the arrangement of the characters is quite haphazard, instead of in two definite lines, though this is very rare

[1] This seal, which is thin, may have had the face removed for the purpose of re-cutting.

(Nos. 52, 247). The seals shown in Nos. 93, 302, 387, 550 are the only ones on which the characters are placed otherwise than along the top, except for No. 387, whose motif is so entirely unusual that one hardly wonders at the inscription occupying a different position.

Coating. Almost all the seals, of whatever type, are coated or have been coated, with a smooth, glassy-looking substance which was at first thought to be the remains of a glaze, whose colour has entirely disappeared. Under a strong glass, this coating shows definite cracking on some of the seals. All the seals have been carefully examined for traces of colour, but without success. The coating has, moreover, been analysed by the Archaeological Chemist in India, who reports negative results as regards traces of copper. On the other hand, the glaze of a seal of exactly the same description as those of Mohenjo-daro and Harappā, which I found at Kish in Mesopotamia, still showed traces of its original blue or green colouring. There is thus no evidence that the seals of Mohenjo-daro were originally coloured.[1] If they were so coloured, all traces of the pigment have entirely disappeared through long deposit in the damp and salty soil of the site. That a copper compound can be entirely removed in the course of time through the action of salt is well known, though the glaze may remain quite intact.

Analysis of coating. Mr. Sana Ullah has since made an exhaustive analysis of the surface coating on one of these seals (DK 4479), and his results are given below :—

	Per cent
Silica	61·2
Oxides of aluminium and iron	2·4
Lime	Nil.
Magnesia	34·6
Water (by difference)	1·8
Total	100·00

In another seal (DK 3557), the amount of water was found to be 2·17 per cent. The analyst remarks that "this surface substance is steatite or talc that has been deprived of the greater part of its water, which is only possible by ignition".

Coating same material as seal. It seems certain, therefore, that the coating upon these seals is made of the same material as the seals themselves. There is reason to think, however, that the coating was an applied one, for it scales off in the same manner as a slip would do. Possibly, before a seal was considered ready for engraving, it was coated in order to conceal blemishes and then was baked in a kiln. The result of the firing was undoubtedly to whiten and improve the outside; for many of the broken seals show that the colour of the stone of which they were made was originally grey. Besides whitening the surface of a seal, the baking would materially assist in hardening it owing to the loss of water that would result. The process appears to have been carried out before the seals were engraved, for the deeper incisions frequently betray the inferior colour in the core of the seals.

Purpose of the Seals

Sealings. It is not quite certain whether these objects should rightly be classed as seals only or as amulets, for the reason that up to the present there has not been found at Mohenjo-daro a single true sealing; that is, an impression on a piece of clay or other substance that had been attached

[1] That the art of glazing was practised at Mohenjo-daro is amply proved by the number of faience objects that have been unearthed.

to a jar or other article of merchandise, of the kind so well known at other ancient sites, where they were fastened to the object to be sealed by means of a cord, or else they bear traces on their backs of some fabric to which they were once attached. The only seal-impressions which have been found at Mohenjo-daro are on baked clay or faience, and as there is reason to infer that they served as amulets, they are described as such later in this chapter.

Use of materials other than clay. Though clay may not have been used for seal impressions, it is likely enough that some other plastic material, such as bitumen, may have taken its place. Bitumen, when old, breaks up into granular fragments except under favourable circumstances, and sealings in this material would be very difficult to detect in such a site as Mohenjo-daro. Another substance that might equally well have been used is resin, and this material is sometimes liable to granulation in a damp climate. We have, actually, found no traces of either of these two materials, except for the bitumen that was employed, in one building only, for water-proofing the walls of a tank.

Personally, I am of the opinion that these seals were used almost exclusively for stamping sealings of clay, which, unless it were baked or of a special quality, would be unlikely to survive in a site that is, or has been, damp.[1] It is quite possible that clay sealings have not been found at Mohenjo-daro for this reason.

Seal impressions from Yokha. That these objects from Mohenjo-daro were actually used to stamp sealings seems to be proved from an impression found at Yokha in Babylonia, which has been published by Dr. Scheil.[2] This clay sealing bears the figure of a bull with a line of pictographs above it, and both the form of the bull and the characters of the script are identical with those on the seals we are discussing. The back of this sealing bears the impression of some woven material, showing, Professor Sayce suggests,[3] that it was once attached to something in the nature of a bale, which would probably have come from India.

Use of seals for colours. Another suggestion has been put forward, namely, that these seals were used, not for stamping plastic materials, but for making coloured impresses on other substances. This theory is, I think, untenable ; for if they had been used for this purpose, they need not have been cut so deep. And details on the lower parts of the engraving of the seals would not have shown at all in an impression made with colour.

Use as amulets. It has also been suggested that these objects were used as amulets. The fact, however, that most of them have a projecting boss at the back seems to me to disprove this theory, to which I was myself at first inclined. An amulet to be effective must be worn on the person, suspended either by a cord or enclosed in a case. It is certain, I think, that the primary object of the boss was to provide a finger-hold. As a means solely of suspension, it would not be so convenient as a hole through the amulet itself. Moreover, the boss would prevent the seal from lying close to the skin.

Seals to contain amulets. The amulet theory finds some support, however, in the shape of seal HR 4629 (Pl. CII, *9*). This seal measures 0·77 in. square and 0·3 in. thick, excluding its boss. The interior has been carefully hollowed out to form a compartment measuring 0·65 in. square by 0·1 in. deep. This little chamber was formerly closed by a sliding cover that fitted into grooves cut in the two sides of the seal. Practically all the face of the seal is missing, but enough remains to show that the animal represented on it was the unicorn and that there was the usual line of inscription above it. An impression of this broken face is shown as No. 293 in the seal plates. Two of the sides of this seal bear a single character each. Except

[1] It is worthy of remark, however, that quantities of clay sealings have been found on sites of the historic period in India, where the rainfall is much heavier than in Sind.—[Ed.]

[2] *Revue d'Assyriologie*, xxii, 2 (1925).

[3] *Antiquity*, June, 1927, p. 205, note.

for the compartment inside it and the characters on its edges, this seal resembles the others of its type in every way.

Owing to its necessarily small size, the compartment would be of little use except to hold a sacred object. This may have been an inscribed copper tablet, similar to the many found at Mohenjo-daro, or an inscription written on some material such as bark or leather, which could conveniently be folded up small. This type of seal would, like the Egyptian scarab, serve the dual purpose of amulet and seal.[1]

Animal device itself useless as a seal.

Were it not for the inscriptions upon them, these seals would be useless as such, for it would be difficult to tell them apart owing to the sameness of the animal motif on the majority of them. The animal itself should be regarded, I think, as possessed of special powers; and it was perhaps primarily for this reason that it was engraved on the seals.

The inscription, which from its variation seems to bear no reference to the animal figured below it, may be assumed to be the name of the owner of the seal. Of the five fragments of pottery that have been found bearing seal-impressions, three appear to have been marked with a rectangular seal, and two with a square seal.[2] In one case, however, the animal appears faintly below, as if by mistake (Pl. LXXVIII, 3).

Dual use.

It would, therefore, appear that these so-called seals were in fact actually used for sealing purposes. Of this use the Yokha sealing seems conclusive evidence. Sometimes the whole seal and sometimes only its inscribed portion was employed. The certainty that these seals were used to stamp pottery vessels, the impressions being made before the jars were baked, is significant.

Inscriptions.

On some of the seals there is barely room to accommodate the inscription, e.g., on Nos. 237, 253, 373, etc., whereas on others only two or three signs were required, as in Nos. 244, 252, 254, 378, etc. It is possible that the shorter inscriptions are simply the owner's name and that the longer ones include titles that the owner of the seal happened to possess. It is noticeable, moreover, that many of the inscriptions begin with the same sign, which may possibly be an invocation; it would more likely occur at the beginning of an inscription than at the end. On the other hand, many of the inscriptions, if they are to be read from left to right, terminate in the same sign, as, for instance, Nos. 105, 109, 110, 134, 148, etc.

No resemblance to foreign seals.

None of the seals of other ancient civilizations resemble those that have been found at Harappā and Mohenjo-daro, either in their devices or the pictographs they bear, or even in shape. It is difficult to understand why the superiority of the cylinder seal over the stamp seal was not appreciated by the people of the Indus Valley civilization.[3] That they must have known it is indicated by the fact that seals from Mohenjo-daro or similar sites have been found both in Elam and Sumer, which argues that these two countries were visited by Indians, probably in the way of trade. We have, however, no definite evidence that India was equally well known to these two countries, although the painted pottery and other objects demonstrate a connection between them all.

The large number of the seals found at Mohenjo-daro and at Harappā seems to call for explanation.

[1] Since the above was written, other hollow seals of this type have been found at Mohenjo-daro and elsewhere.

[2] See Pl. LXXVIII, 1 and 3, and Pl. CXV, 558, 559, and 560.

[3] Since writing, a cylinder seal has been found at Mohenjo-daro. The devices upon it are quite unlike anything that we know outside India. It is not known whether the stamp form of seal antedates the cylinder seal or not. The probability is that it does. In Egypt, however, the cylinder seal gave place to the stamp-seal. At Jemdet Nasr, the oldest site that has hitherto been found in Mesopotamia, the stamp and the cylindrical form of seal are found together. In Elam, stamp-seals are only found in levels belonging to Susa I. At the time of Susa II, the cylinder seal appears.

Judging from the number that have been found in the houses of the poor and rich alike, it is reasonable to surmise that they were not always carried on the person ; indeed, the very large size of some of them would make them awkward things to carry.

We have as yet no definite knowledge of how the Indus Valley people disposed of their dead.[1] If cremation was practised, the seals seem to have been removed from the bodies, as they are for the most part untouched by fire. If the bodies were buried, the seals may also have been removed, though this was not the case in Babylonia, where men and women took their seals with them to the grave. Assuming that the seals were used for legal purposes by the people of Mohenjo-daro, they would doubtless have been regarded as valued possessions, and, to avoid forgery, care would have been taken to prevent their getting into unauthorized hands. They would thus have been removed from the dead and kept by relatives until time rendered them of no further use.

The number of broken and damaged seals that have been found, which may have been accidentally lost or purposely discarded, is comparatively small. The majority are in a good state of preservation ; indeed, some show but little evidence of use.

The Animals Represented on the Seals

The So-called Unicorn

One-horned (?) beast.

The animal most often represented on the seals is the apparently single-horned beast seen on Nos. 1–297 and 537–57. There is a possibility, I think, that the artist intended to represent one horn behind the other.[2] In the other animals, however, the two horns are shown quite distinctly.

In some respects the body of this beast, which is always a male, resembles that of an antelope of heavy build, such as the eland or oryx, and in others that of an ox. The long tufted tail may belong to either class. The horn is sometimes smooth (Nos. 2, 4, 15, 18, etc.); sometimes it has transverse ridges (Nos. 6, 9, 11, etc.). In the latter case, the possibility of the creature being an ox is ruled out. The long pointed ears are also characteristic of the antelope. Perhaps we have here a fabulous animal which is a composite of the ox and the antelope. And yet to the casual eye there is nothing fantastic about it, as about some of the other animals represented on the seals ; nor does it in any way resemble the unicorn of heraldry, which is made up of different parts of a number of animals, though it must be noted that the traditional unicorn was supposed to have originated in India. It is mentioned by Ctesias and Aristotle as peculiar to that country and is called by them the Indian ass. For the sake of convenience, however, we shall designate this animal a " unicorn ", until a more fitting name has been found for it.

Markings.

The curious markings that occur on the shoulders of these animals, and of these alone, appear to represent trappings of some kind rather than muscles or wrinkles in the skin. The curious lines around the neck of the animal on some of the seals (Nos. 4, 12, 36, etc.) certainly suggest folds of skin, but they do not occur in all the animals. Possibly they represent wire ornaments suspended round the neck, but against this theory is the fact that similar markings occur on the heads of the animals. Perhaps these lines are intended to represent hair.

In other cases (Nos. 2, 15, 22, 23, 29, etc.), a more or less elaborate necklace is substituted for these lines.

[1] See, however, Chap. VI *supra*.—[Ed.]

[2] The same type of animal, but with two horns, has now been found on a seal from Harappā. These horns, however, resemble in shape the horns of an ox rather than the long projecting horn that the unicorn on our seals always has. Animals in profile are quite commonly represented with one horn on Sumerian seals.

A prominent feature about this beast is the striking eye and the well-marked eyelid above it. It is, however, not characteristic of all the animals of this type, as may be seen by comparing Nos. 2 and 4 with Nos. 16 and 17, for instance. In the former, the eyes are definitely cow-like and, moreover, set in their proper place in the head, whereas in the latter, the eye is entirely different and has something of the camel's eye about it.[1] **Eye.**

There is always a very curious standard-like object in front of this so-called unicorn that appears in conjunction with no other animal.[2] The lower portion of this object appears to be a bowl-like receptacle on an upright support. In some cases this bowl—if indeed it is hollow—appears to be made of basket-work (Nos. 4, 21, 22, 25, 32, 33, etc.), in others of some embossed material, perhaps leather (?) (Nos. 3, 9, 11, 15, 16, 18, etc.). Sometimes the bosses entirely cover the outer surface of the bowl, in appearance recalling the knobbed pottery illustrated in Pl. LXXVIII, 16.[3] I suggest leather as the material used for these bowl-like objects, as rosettes could hardly have been attached to basket-work; but wood may have been employed as well. **Standard in front of animal.**

It is not clear whether or not these bowls were closed in at the top. I am inclined to think that they were, for the supports of the upper portion of the object apparently rest on the upper surface of the bowl. These supports appear to be single on some of the seals (e.g., Nos. 11 and 18), on others they have a stay-like appearance (e.g., Nos. 15 and 38). A very curious variation, of which only one example is known at present,[4] is a series of points placed either around the rim of the bowl or over its upper surface (Pl. CII, *c*, and No. 38).

Each of these apparent standards has a staff-like support that appears to run right up through the bowl to the object above it. A pin is sometimes shown run through the staff to prevent the bowl from slipping down, as is seen in seal 38 and less distinctly in others, e.g., Nos. 2, 11, 16, 66, etc. The base of the staff invariably thickens towards the foot, as would be the case with any pole, if not especially trimmed. We may take it for granted that the staff is of wood or metal, and not of pottery like the ordinary offering-stands that are so common at Mohenjo-daro and Harappā. The stem is much too thin to be made of anything but wood or metal, and the deep bowl-like object above it is quite unlike the shallow pans of the offering-stands. It is not apparent whether the base of the staff was fixed in the ground, but as it is always represented as being on exactly the same level as the feet of the beast behind it, we may suppose that it was so fixed. **Support of standard.**

The object above the bowl is also very puzzling. On all the better finished seals it appears to be openwork, whether made of metal, wood, or basket-work.[5] Its shape is fairly uniform—either bee-hive shaped or square with incurved sides. It was possibly a cage, and we may perhaps compare it with the pottery cages seen in Pl. LXXXIV, 1 and 2. On some of the seals it appears to be closed in above (Nos. 2, 3, 9, 11, 15, 16, 17, 18, etc.), so that it could hardly have been used as a manger. Indeed, in Nos. 3, 15, 17, 19, etc., it appears to have a knob or handle on the top. **Possible cage.**

Whether the staff ran right through the upper object we do not know, though the general

[1] What seems to be the same animal, but modelled in clay, is shown on Pl. XCVI, 23.

[2] There are, however, exceptions. In front of the animal on seal 550 there is what may be either a pictographic sign or a feeding trough divided into compartments. Seal 93, which is also peculiar in other ways, is another exception, and a third is No. 167, on which a plant or a symbol of some kind stands in front of the animal.

[3] No bowls, however, have as yet been found made of knobbed ware, which is at present only known in two particular shapes.

[4] That is, at Mohenjo-daro. Other examples occur at Harappā. For an explanation of these "points", see p. 69 *supra*.—[Ed.]

[5] The varying weaves are certainly suggestive of basket-work.

appearance of these apparent standards certainly suggests that it did. On the other hand, in seal 17 the portion of the support between the bowl and the upper object takes a lattice-work form.

These "standards" appear always to have been made of perishable material, and it seems likely that we shall never find any actual examples at Mohenjo-daro to elucidate their make and purpose.

Variation in shape.

The variety of ways in which these apparent standards are portrayed upon the seals suggests that they were not all copied from a single original kept in some temple or other building. The representations on the seals are evidently copies of objects of which many existed, and in the making of which a certain amount of latitude was permitted. For instance, there are several points of difference in those seen on seals 15 and 18, and again on Nos. 37, 38, and 40. The upper portion alone varies in shape, but both the upper and lower objects differ in structure and mode of decoration.

Suggested interpretation.

Unfortunately, I am unable to suggest the significance of these apparent standards. Cult objects such as these seem rarely to be capable of explanation, unless one has the actual objects to examine and not only representations of them. The looseness of the weave of the upper portion of the standard certainly suggests a cage, and with diffidence I suggest that it held a bird. As is well known, birds are often intimately connected with bovine and other creatures, helping to relieve them of ticks and sometimes giving alarm at the approach of danger. If such an animal as this so-called unicorn really once existed, and if it was considered sacred, it seems to me that any animal associated with it would also be considered sacred.[1]

Used in processions.

On two impressions which were evidently made from the same seal (Pl. CXVI, 5 and 8 ; Pl. CXVIII, 9), there is a most interesting little scene showing four men in file, each carrying a standard. Owing to the impression being smaller than the seal, the upper parts of the standards and the legs of the bearers are missing. Fortunately, however, enough remains of the two last standards to show that the animal on the last but one is the same as the "unicorn" type of animal. The object on the standard behind appears to be identical with the supposed cult object that is always placed in front of the unicorn on the seals. There is no doubt, I think, that on this impression we have the representation of a sacred animal being carried along in procession.[2]

Possible deities.

This little scene opens up a new vista ; it indicates that at least one animal was worshipped either as a god itself, or, which is more probable, as a manifestation of a god. If this should subsequently prove to be true, there is every probability that the other animals portrayed on the seals also represent deities ; possibly of lesser rank, since they figure less frequently.

If we ever find the seal from which these two impressions were taken, we shall perhaps find others or all of the animals represented on the seals taking their places in the procession. As before mentioned, the seal was considerably larger than the impression, and it is possible that the owner of the seal required only the impression of the "unicorn" for his purpose.

It should, however, be borne in mind that these animals may perhaps represent the deities of provinces, in exactly the same way as do the "*nome*" animals of Egypt, all of which are commonly shown on standards very similar to the ones carried by the men in the Mohenjo-daro impressions. There is, however, a serious argument against this latter theory. The unicorn type of animal occurs just as frequently on the seals from Harappā, 400 miles away, as at Mohenjo-daro, which would hardly be the case if the animal was the symbol of a province.

[1] For a different explanation of these curious objects, see *supra*, p. 69.—[Ed.]

[2] Cf. this scene with one on the mace of Narmer. See Quibell, *Hierakonpolis*, pt. i (1900), pl. xxvi.

Nome-symbols. I do not suggest that Mohenjo-daro had anciently any considerable connection with Egypt. But in some small respects the beliefs of the two peoples were clearly similar. The facts that at Mohenjo-daro certain animals were probably sacred, that a cult object was associated with the chief of them, and that both animal and cult object were sometimes carried on standards in procession, are strongly reminiscent of the practice of ancient Egypt, where cult objects were always associated with the sacred or "*nome*" animals carried there on standards.

The Short-horned Bull

Character of bull. The animal next in order of popularity was the short-horned bull seen on seals 308–26, 487, 536, and 557*b*. There is, fortunately, no doubt whatever about this animal, which is also very commonly represented in pottery, sometimes roughly made by children, sometimes exceptionally well made, presumably for votive purposes. It is remarkable that in all its representations, both on the seals and as pottery figures, the head is always lowered and twisted slightly to one side, as if the animal were just about to charge.[1] The fact that the bull is always shown in angry mood suggests that this aspect of it was significant. Possibly the animal may have been the emblem or vehicle of a god of war or destruction.

Wrinkles. In most cases the heavy wrinkles on the shoulder of the bull are shown with fidelity, and sometimes the dewlap also. The fact that these wrinkles somewhat resemble those on the unicorn's neck and head lends some support to the view that in the latter animal also wrinkles and not garlands are indicated. On several of the seals, Nos. 310, 312, 316, 318, etc., the animal wears an ornamental collar or garland around the neck.

Manger. In every case there is a low manger (?), flat-based and with concave sides. This manger is distinctive, and though the bull itself is duplicated in the art of the surrounding countries, yet the unusual shape of the manger is characteristic of the art of the Indus Valley civilization. The point is stressed because the occurrence of the same form of manger on a cylinder-seal of bone found at Susa[2] leaves no doubt, I think, that this seal either came from India in the first instance, or, as is suggested by its very rough workmanship, was engraved for an Indian visitor to Susa by an Elamitic workman.

At first sight the attitude of the animal suggests that he is about to eat from the manger ; but that his head is really intended to be lowered in anger seems to me indicated by the pottery figures of the same animal being obviously made to represent him in angry mood (Pl. XCVII, 23–6).

Materials. The manger appears in most cases to have been of some such material as pottery, but No. 536 suggests that it was sometimes made of basket-work. The manger on this particular seal seems unmistakably to be made of reeds, or a similar material.

The bull represented in seal No. 542 is differently portrayed from the other bulls on the seals. The head is not lowered as if to charge, and a kind of cup is substituted for the usual manger.

A most interesting seal found by Mr. Woolley at Ur[3] bears the device of this type of bull with head lowered exactly like the bulls on seals 308–26 from Mohenjo-daro. The curious thing about this seal is that the inscription upon it is in cuneiform characters,

[1] There can be little doubt that the animal in question is the Indian bison or Gaur (*Bos gaurus*), of which the attitude portrayed on the seals is a most striking characteristic.—[Ed.]

[2] *Catalogue des cylindres orient.*, *Musée du Louvre*, vol. i, pl. xxv, fig. 15. See also J. de Morgan, *Prehistoric Man*, p. 261, fig. 171 ; *Mém. Dél. en Perse*, t. ii, p. 129.

[3] Sidney Smith, *Early History of Assyria*, p. 50, fig. 3 ; *The Antiquaries' Journal*, vol. viii, pl. xi.

and not in the script of the early Indus Valley, but the syllabic values of the signs are uncertain.[1] From the forms of the signs upon this particular seal, it can be dated to the pre-Sargonic period. It is not outside the bounds of possibility that the language used on this seal is an Indian one and that the seal belonged to an Indian trader who was residing at Ur. For business purposes he naturally preferred to use a script on his seal that his Babylonian customers would understand. At the same time, the figure of the bull with its manger was retained, perhaps to show that the trader was an Indian.

To whomsoever this seal belonged and whatever its inscription, it is of especial value because it confirms our dating of the Indus Valley civilization. The posture of the bull, together with its manger, proves it to have belonged to a man who was acquainted with Indian culture, and its inscription shows that that culture was existing at or before the time of Sargon the Great.

Buffalo (Bos bubalis)

Characteristic attitude.

This animal is rare and only appears on three of the seals (Nos. 304–6). On all three it is in a very typical attitude, with nose up sniffing the air. In fact, like most of the buffaloes of the modern Indian village, it appears to be in a belligerent mood.

On two of the seals, there is exactly the same form of manger as in front of the bulls, but on the third (No. 304) this feature is missing and there is nothing—there is no inscription either—to take its place. This seal, however, appears to be unfinished. The portrayal of the animal is exceedingly natural, and we can only regret that the workmanship of these three seals does not approach the level of some of the others. The manger on seal 306, again, appears to be made of basket-work.[2]

Brahmanī Bull (Bos indicus)[3]

Careful delineation.

We have certain proof in Nos. 327–40, and possibly No. 542,[4] that this type of bull was known in India in very early times. The characteristic hump on the shoulders allows of no doubt whatever. Fortunately, the majority of the seals on which this animal is represented are well preserved. Indeed, rather more care seems to been have taken with the portrayal of this animal than with some of the others. No. 337 is marvellously well engraved and finished; in feeling and in the careful portrayal of the muscles it will compare favourably with early glyptic art anywhere. The heavy wrinkled dewlap is especially well done, as is the case also with the bulls of seals 333 and 339. On seal No. 337 a band or garland of some kind has been thrown over the bull's shoulders; and on seal 333 the shoulders together with a portion of the hump appear to be draped with some material. It is possible that in the latter case the seal cutter has made a slight mistake; for, if rolls of skin are intended, the hump should have been left round and smooth. There is no cult object of any kind represented in conjunction with these bulls. Apparently the Brahmanī bull

Garlands.

[1] See pp. 406, 412, and 413 *infra*.

[2] Compare the setting of the heads and horns of these buffaloes with the method of portrayal on Sumerian seals, as for instance, the seal said to have belonged to Sargon of Agade. Peake and Fleure, *Priests and Kings*, p. 55, fig. 24.

[3] The humped bull is more fully dealt with in Chapter XVIII, on Figurines and Model Animals.

[4] I regard the animal on this seal as being of the humped variety with short horns.

does not appear on any of the seals or pottery of either Sumer or Elam.[1] It first appears in Babylonian art about the time of Gudea on a limestone bas-relief.[2] It is also shown on a painted sherd from Nāl in Balūchistān.[3]

Rhinoceros (R. unicornis)

This animal also rarely appears on the seals, Nos. 341–7 being the only examples that we have as yet. In every case it is the single-horned animal that is represented, probably the great Indian rhinoceros which was formerly found along the base of the Himālayas as far as Peshāwar, where it was hunted by the Emperor Babar.

Great Indian rhinoceros.

This animal's thick hide is well represented on seal No. 345, where the wrinkles and folds of skin are very true to life. Rough excrescences on the skin are indicated in some of the examples by means of holes made with a fine drill. In others hatched lines are employed. In every case the animal is rendered with extreme fidelity, even to the wicked pig-like eye.[4] From this, I think, it can safely be affirmed that the animal was very well known to the people of Mohenjo-daro ; in ancient times it was probably very common in Sind and perhaps still further west. It does not appear on any of the seals from Elam or Mesopotamia.

Excrescences on hide.

The rhinoceros is, curiously enough, provided with the same kind of manger—more probably a cult object—as the short-horned bull.

Manger.

The animal represented on a fragment of a seal (No. 354) is difficult to identify. At first glance it seems to be a rhinoceros, especially as the fore and hindquarters bear drill-marks similarly arranged to represent roughnesses as on the other rhinoceros seals. The legs of the animal, however, are much too thin for those of a rhinoceros ; they resemble rather the legs of a bull or ox.

The rhinoceros was very commonly modelled in clay and was a favourite with the children. It must, therefore, have been very well known to them (Pl. XCVII, 8–11).

Clay models.

Tiger (Felis tigris)

That the animal on seals 349–53 and 355 is the tiger is proved, I think, by its being striped. This animal is now extinct in Sind,[5] though it is found in most of the wilder parts of India. Unfortunately, some of the seals upon which the tiger appears are badly broken. In two (Nos. 350 and 351) the animal is very quaintly represented with a manger before it of identically the same pattern as provided for the short-horned bull and rhinoceros.[6] Two seals in this group are of especial interest (Nos. 353 and 355). On both a man is seated in

Existence in Sind.

Tiger and man.

[1] It appears, however, carved on archaic bitumen vessels from Susa. *Mém. Dél. en Perse*, t. xiii, pl. xxxiv. See also Scheil, *Recueil de signes archaïques*, p. 11.

[2] King, *History of Sumer and Akkad*, p. 69, fig. 21.

[3] See Pl. XCIII, 30 of this work. Also *Mem. Arch. Surv. Ind.*, No. 35, pl. xvii. [It should be added that it is a very common motif on the Mehī-Kulli ware of Balūchistān. See pp. 98–9 *supra*.—Ed.]

[4] Seals Nos. 342–5 are good examples of this fidelity. The great Indian rhinoceros is characterized by the skin of the sides of the body being thickly studded with large rounded tubercles and also by the great folds of skin which surround the back of the head like a coif. Lydekker, *Game Animals of India*, p. 28.

[5] The last specimen was killed in 1883.

[6] A seal in the Louvre bearing the device of a tiger standing over a manger is illustrated in *Revue d'Assyriologie*, xxii, 99. M. Thureau-Dangin, who published it, suggests that it came from Telloh.

a tree with a tiger below regarding him attentively. In each case the man clasps the tree with one hand ; the other he is holding out as if he were apostrophizing the animal. As this scene occurs on two of the seals it seems that it was not entirely an unusual one. The nearest analogy we have to it is a scene on a limestone cylinder seal of the neo-Babylonian period from Kish.[1] In this a man is seated in the same attitude in a tree, with a hyena at its base.

Elephant (*Elephas maximus*)

Careful portrayal.

This animal figures on fifteen of the seals, Nos. 362–76. In fact, it may be said to rank next in order of popularity to the bull. On most of the seals it is carefully portrayed, in some cases even to the wrinkles along its back. On one seal only (No. 369), the same low manger or cult object is placed before the animal as on the seals representing the short-horned bull. In some cases the elephants appear to belong to the present sole existing species in India, but in others (Nos. 369–72) the back has a pronounced slope which recalls the African variety. The comparatively small ears, however, are against any connection with the African elephant. The animal is no longer found in Sind, but it occurs wild in places along the base of the Himālayas as far west as Dehra Dun. It is not certain whether trappings are represented on seals Nos. 369, 370, and 373, or the vertical folds of skin at the junction of the limbs. This animal is sparsely represented in pottery. For an example see Pl. XCVI, 10, where, however, the trunk is broken and missing.

Rarely represented in pottery.

Trunk recalls African species.

Lydekker remarks that one of the differences between the Indian and African elephant is that the former has a finger-like process on the front edge only of the tip of the trunk, whereas the African species has two such processes, on the front and hind margins respectively.[2] In seals 367, 371, 372, 534, and 535 two processes are definitely shown, though the animals portrayed belong to the Indian species, as shown by the smallness of their ears, the flatness of their foreheads, and the profile of their backs. It may be, however, that the animals seen on these seals represent a species of elephant that is now extinct in India. The presence of two processes on the trunk on no less than five seals can hardly be regarded as a mistake on the part of the seal-cutter, though that mistakes were sometimes made is shown by the wrongly placed eye on seals 372 and 534, and the absurd ear, if it is an ear, on seal 369. Possibly the elephant was not so well known to the inhabitants of Mohenjo-daro as we thought at first. It may never have been wild in Sind and have been used by a few people only for purposes of state.

Mistakes in carving.

Gharial (*Gavialis gangeticus*)

Fish-eating crocodile.

The reptile shown on three of the seals (Nos. 359–61) and on two of the sealings (Pl. CXVI, 14 and 20 ; Pl. CXVIII, 10) is the fish-eating crocodile which still inhabits the Indus and other rivers of India. It can be readily identified by its very elongated, thin snout. On both seals and sealings a fish is generally represented between its jaws. On No. 360 the scales are represented by hatching, but in No. 361 holes were drilled to indicate the scaliness of the creature. If this animal was sacred, it must have been selected for some other attribute than fierceness ; for it is harmless to man.

[1] In the Ashmolean Museum, Oxford.

[2] *Game Animals of India*, p. 10.

Antelopes

Antelopes are very rarely represented on the seals of Mohenjo-daro (Nos. 302–3), whereas the motif is very common on the Sumerian seals.

Rarely represented.

That the animal portrayed on Seal No. 302 is an antelope is suggested by the shortness of its tail. In general appearance, however, it resembles the so-called unicorn, with the difference that it clearly has two horns. This seal is also unusual in having two characters in front of the animal.

That No. 303 definitely portrays an antelope is shown by the long curling horns. The little shrub in front of the animal is characteristic of many of the archaic Sumerian seals, where also it occurs in conjunction with an antelope. The animal wears a collar, apparently made of some woven material, with a pendant in front which may possibly be a bell.

Collar.

Mythological Creatures

Of these, Seals Nos. 356, 357, and 358 represent human or partly human forms. The human figures in No. 356 occur on the two ends of Seals Nos. 227 and 230, which bears an inscription together with an animal on each of its larger faces. These human figures have the hoofs, horns, and tail of a bison,[1] and the left arm of each is raised above the head while the right hangs down by the side. Both these figures closely resemble *Enkidu*, the companion of *Gilgamesh*, whose head, shoulders, and arms were human, but with the addition of a pair of bison's horns.

Enkidu.

The same figure appears again on Seal 357, where he is struggling with a fabulous beast, the greater part of which is tiger-like. On seals and other objects from Sumer, *Enkidu* is always shown struggling with a lion and his companion *Gilgamesh* with a bull, but it is possible that at Mohenjo-daro the tiger was substituted for the lion, which animal never appears on the seals. The treatment of the tree behind the hero is extremely realistic, both in its very careful drawing and its pleasing irregularity. One feels that such a tree could be found almost anywhere in the east, cropped by animals and broken down by man. The horns on the head of the animal, whose stripes show it to be a tiger, do not resemble those of any particular beast; without them, this would be an exceptionally good representation of a tiger, for the mouth is open and the canine teeth are showing.

Wrestling with mythological creature.

The man in No. 358 is probably not mythological at all. He is evidently engaged in working a *shadoof*, whose counterpoise is seen at the end of the pole above and behind his head.

Shadoof.

The animal on Seals 376 (upper figure) and 377–81 appears to be a ram, with the horns of a bull, a human face, and the trunk and tusks of an elephant. That the body of this composite beast is a ram's body is indicated by the long locks of wool on its fore-quarters. The hind-quarters and hind-legs are, however, those of a tiger. On those seals where the face is not broken away, it appears to be human, and the eyes, like those of the statues, are very elongated and slit-like.

Composite animal.

In No. 381 the beast has three ornamental collars. In Nos. 378, 380, and 381 it has its tail straight up in the air and in No. 378 this tail is armed with pincers.[2] This fabulous

Tail armed with pincers.

[1] The horns are certainly those of a bison (*Bison bonasus* or *Bos gaurus*). See on this subject, Ward, *Cylinder Seals of Western Asia*, pp. 426–7.

[2] Compare this animal with the creature described by Ctesias, called Martikhora. It was said to be as large as a lion, with a human face, and to shoot stings out of the end of its tail.

beast closely resembles the stone figure of the ram illustrated in Pl. C, 9, but, unfortunately, in the statue the head is very badly broken and we are unable to say whether the resemblance is complete in all respects. The elephant's trunk is, however, clearly indicated in the statue.

Seal 384 is very badly weathered, but on the right side the two horns of an animal and a portion of its head can be traced. The horns somewhat resemble those of the composite animals just discussed.[1]

Three-headed beast.

The three-headed beast on seal 382 appears to be a composite of three animals. The heads and horns seem to be those of antelopes and the body that of a unicorn. The heads have been joined to the body very carefully. One is eating, the second looks straight ahead, and the third is looking backwards in apparent alarm. If any two of the heads were removed and the tail shortened, quite a normal animal would be left. From the way in which the heads are arranged, it is probable that the seal-cutter carved the central head and the body of the animal first and then added the extra heads.

Arrangement of horns.

Owing to insufficient room, the horns of the lowest head are rather different from the others; they resemble a bull's horns rather than those of an antelope. Again owing to lack of room, the horns on the middle head, though obviously an antelope's, are reversed in position. Judged by the shape of the body, the markings on the necks and the trappings over the withers, it seems evident that the animal, except for the horns, was intended to be the so-called unicorn.

Triskillion.

The design on No. 386 is most complex. The animals appear to be tigers whose three bodies cross one another in the centre. In archaic fashion, every available space on the ground of the design is occupied by pictographs.[2]

On the broken seal, No. 383, the heads and necks of six animals radiate outwards from a ring-like motif. Of the four unbroken heads, one is a unicorn's, another a short-horned bull's, the third an antelope's, and the fourth a tiger's. The remaining two heads were probably those of a rhinoceros and an elephant.

Mythological beast.

The fantastic creature on No. 385 is unique. The drill marks on the body are apparently intended to represent spots, and the long horn just above the nostrils is evidently taken from the rhinoceros.

Plant-Forms

Pipal tree.

The representation of plant-forms on the seals is rare; they occur only on twelve seals, Nos. 22, 126, 167, 303, 340, 352, 353, 355, 357, 382, 387, and 527. On only two seals is a plant-form the central motif (Nos. 387 and 527). The plant on the former has been identified as the pipal tree,[3] which in India is the Tree of Creation. The arrangement is very conventional and from the lower part of its stem spring two heads similar to those of the so-called unicorn. The very conventionalized arrangement of the leaf-stems is not only decorative; it enables the whole ground of the seal to be filled up by the stems and leaves without confusion. The lower portion of the seal is filled in with pictographs. It may be the *babul* or the *jhandi* tree, that is represented on four other seals (352, 353, 355, 357). They are the commonest trees of the neighbourhood of Mohenjo-daro at the present day,

[1] This linking together of the ram, elephant, tiger, bull, and human form may be an attempt at the fusion of several deities; it is perhaps a step on the road to monotheism.

[2] Compare the designs with some seal impressions of the Persian Period, dated about 464–404 B.C., found at Nippur. Legrain, *Culture of the Babylonians*, pl. lv.

[3] *Ficus religiosa.* The leaves of this tree constitute a common motif on the Nal pottery (Pl. XCIII, 2 and 3). It does not appear on the pottery of Mohenjo-daro. See Pl. CLIV, Fig. 9.

and are rather straggling in growth, with small leaves.[1] That it was intended to represent trees and not shrubs is proved by there being a man in the tree on two of the seals.

Order in popularity. Out of 387 seals bearing non-fabulous animals, the unicorn appears on no less than 312, showing the great popularity of this animal. The short-horned bull is a poor second, appearing as it does on twenty-two seals. There are seventeen examples of the elephant and fourteen of the Brahmanī bull. The rhinoceros and the tiger come next with seven representations each. The buffalo and the gharial appear three times each, but of the antelope there are only two examples, excluding the heads on Nos. 382 and 383.

Lion. It is a curious fact that the lion is not represented on any of the seals, the more so, as it appears repeatedly on the archaic seals from Elam and Sumer. In the early seals from Kish it was one of the most frequently portrayed animals. It was generally represented as attacking a herd of antelopes, showing that the herdsman in early Babylonia was perhaps better acquainted with the beast than he desired. The lion though extinct in Mesopotamia is still found, it is said, in remote parts of Persia. In India it is now rare, but in the early historic period it extended over a great area of northern and central India. On the seals of Mohenjo-daro the tiger takes the place of the lion, though, it is true, it is but rarely represented.

Antelope. Another significant feature is the rarity of the antelope on our seals, though, as before-mentioned, it appears very frequently on the seals of Elam and Sumer. The short-horned bull is common to the seals of Mohenjo-daro, Elam, and Babylonia, especially on the seals of the latter countries. The Brahmanī bull, elephant, gharial, and rhinoceros are not to be found, to my knowledge, on any but the seals of the Indus Valley civilization.

These facts are of considerable interest as they tend to show that the fauna of ancient Sind was radically different from the fauna of both Elam and Sumer. If this be granted, we can safely say that the physical nature of these countries must have been just as different. The lion and antelope, for instance, inhabit rocky and sandy wastes, and are not to be found in a country of forests. On the other hand, the tiger, the elephant, and the rhinoceros live chiefly in forest country and in high grass near water.[2] These facts would also argue that the climate of Sind was entirely different anciently from what it is at the present day ; at least that portion of it in the vicinity of the Indus river, which even now cannot truly be called a desert. That the rainfall west of Sind, i.e. in Balūchistān, was by no means negligible in very early days is proved by the observations of Dr. Vredenburg, who found in southern Balūchistān ample evidence of a greater rainfall in ancient times, which he suggests may have been modified by forest denudation.[3] Sir Aurel Stein is also of the opinion that desiccation can alone account for the depopulation of southern Balūchistān. The very numerous city and village sites in that part of India prove that in ancient days the population must have been very considerable.

Captive animals. The presence of what seems to be a feeding-pan in front of some of the animals on the seals suggests that they may have been kept in captivity as sacred animals. This manger was always placed before the buffalo, the short-horned bull, the rhinoceros, and sometimes even the tiger and elephant. The keeping of animals in captivity as emblems of various deities is especially well known to us from ancient Egypt, where this was an established religious practice. If it be admitted that the animals represented on the seals were captives,

[1] The *babul* = *Acacia arabica* ; the *jhandi* or *kandi*, as it is otherwise known = *Prosopis spicigera*.—[Ed.]

[2] We have been struck by the number of antlers and bones of the Sambur deer that have been found at Mohenjo-daro. This deer is a forest-loving animal and does not frequent the arid or semi-arid plains.

[3] *Mem. Geol. Surv. of Ind.*, vol. xxxi, part 2, pp. 179–302. See also Pumpelly, *Explorations in Turkestan*, Expedition 1903, pp. 300–15.

the additional fact that some of them are provided with trappings suggests that they were open to the inspection of visitors, and regarded as sacred animals.[1]

Temple models. On the other hand, it is within the bounds of possibility that models of these animals were kept within the temples, either together or each in a temple devoted to a particular deity. The existence of the curious composite animal with ram's body and elephant's trunk, etc., of which we have found more than one example in stone, suggests that something of this kind was done. The people of Mohenjo-daro may have believed that the god occasionally took up his abode in the animal itself and that at stated times offerings were required to be placed before it.

Again, models of animals to which reverence was paid might easily alter in appearance as time went on. Figures of this description would require replacements, and as each was made, some slight change would creep in. For instance, the one-horned beast, which is not far removed from an actual animal, might easily have assumed, from constant copying, the form that we now see on the seals, the animal itself having become rare or extinct.

Animal bones. In Chap. XXXI on the animal bones recovered during the excavations at Mohenjo-daro, which has been contributed by the Director of the Zoological Survey of India, it will be seen that amongst those of other animals which are not pictured on the seals, the bones of the following animals that do appear on the seals, were found, namely, of the gharial, the Brahmanī bull, and the elephant.

It will have been noticed that the majority of the animals on the impressions of the seals, from which the photographs were made, face to the right. On the actual seals, the direction is, of course, the reverse. There are only ten exceptions to this rule (Nos. 112, 167, 272, 302, 304, 307, 341, 352, 376, and 382). Of these there are only three amongst the many "unicorn" seals. Two are buffaloes, one a rhinoceros, one a tiger, and one an antelope. One is an unknown animal and one a composite beast.

Animals used in script. It is remarkable how few animals are used as characters in the inscriptions. We can identify the jungle-fowl, the duck, the fish, and the man. Two of the signs above the bull on seal 338 almost certainly represent jungle-fowl, their long legs and turned-up tails unmistakably marking them as such. We do not yet know whether this bird was domesticated or not. It also appears in seals 36, 207, 228, and 237.[2] On seal 93 there is a delightful sign representing a duck (shoveller?) in a pool of water. This is drawn with great fidelity, even to the turned-up end of the beak. A pea-fowl is perhaps represented in seal No. 144.

Goat. A goat, as shown by the short and uplifted tail, appears on one seal (No. 150); and an animal that may be a scorpion on seal No. 262.

It is likely that the animals portrayed on the seals represent a decadent totemism and that they gradually passed into the religion and became deities, though still retaining their animal form. They appear on the seals of rich and poor alike, as well as in figurines. These latter might perhaps be explained as being due to conservatism; the seals, however, were for use and, in consequence, had to be understandable by even the poorest person, who would recognize the animal, even if he could not read the writing.

Bow and arrow. In some of the inscriptions a man appears to be holding a bow and arrow in one hand (Nos. 12, 15, 60, 65, 69, 70, 92, 400, and 406). On other seals he holds a bent stick or some other object (Nos. 37, 42, 43, 116, 118, 343, and 348). In some cases he carries his bow

[1] On the trappings of sacred bulls in Crete and Cappadocia, see Arthur Evans, *Palace of Minos*, iii, pp. 204–6, and figs. 139 and 140 *a* and *b*.

[2] The jungle-fowl only appears on Mesopotamian seals at a late period. For a good example see Ward, *Seal Cylinders of Western Asia*, p. 339, fig. 1126. It was probably well known in that country long before. In Egypt this typical Indian fowl is shown on an ostrakon dated to the eighteenth dynasty. See *Jour. Eg. Arch.*, vol. ix.

on his back (Nos. 18, 38, 101, 111, 116, 478, and 496), and his arms are drawn up to the breast, as in the figure on the ivory tablet pictured in Pl. CXXXII, 10.

Seal Impressions

In addition to five seal impressions on jars, thirty impressions have been found on tablets of various shapes found at Mohenjo-daro, twelve made of faience and the remainder of baked clay. As, with one or two exceptions, they are not perforated, it is possible that, like some copper tablets, they were used as amulets.

Grouping. These impressions, which are illustrated in Pls. CXVI and CXVIII, can conveniently be divided into four groups for description, namely, impressions on :—

(*a*) Rectangular or Square Tablets.
(*b*) Triangular Prisms.
(*c*) Round Tablets.
(*d*) Impressions on Pottery Vessels.

(*a*) *Rectangular or Square Tablets*

There are altogether eighteen examples in this group which vary slightly in shape, the majority being well made, with flat ends and sides. Others have slightly rounded faces, and one with a flat base has a highly rounded back. The members of this group vary somewhat in size, as will be seen in the detailed list below.

Perforations. Only one is perforated, probably by the owner, who apparently tried at first to drill a hole through the side and gave it up when he realized that it was quicker and safer to make holes through the face. The two that he made disfigure both sides of the impression ; and, moreover, they are cut obliquely (Pl. CXVI, 1).

No. 1 on Pl. CXVI ; Pl. CXVIII, 7 (B 426). Grey-coloured paste. Size 0·8 by 0·77 by 0·35 in. On the obverse is a row of six nude human figures in the upper register, standing side by side with the arms held close to the body. It is impossible to determine whether these figures are male or female. In the lower register is a kneeling figure on the left holding a broad-bladed object in one hand. In front of him is a goat, before which is a partly defaced object that looks like a tree. In the centre of the tree is a human figure. The reverse has exactly the same scene, but it is not so distinct.

Two small holes irregularly placed and running obliquely through the amulet probably served to attach it to the clothing. Level, 8 feet below surface. Room 17, Block 3, Section B, DK Area.

Tree worship. The interpretation that I incline to place on this most interesting scene is that a priest is about to sacrifice a goat to a tree-spirit. In most parts of India at the present day, offerings and occasionally animal sacrifices are made to certain trees to placate the spirits that dwell within them.[1] The cult of the tree was also common to most ancient religions throughout the world. For example, we have the Dryad and the Hamadryad of Greek mythology, and Hathor who dwelt in the sycamore fig-tree of ancient Egypt.[2]

Pipal tree. The leaves of the tree on the sealing are not unlike those of the pipal,[3] a very sacred tree in India in past and also present times. The tree itself appears also on seal 387 in a conventionalized form.

[1] Particularly pipal and banyan trees.
[2] Tree spirits also frequently appear in Buddhist art.
[3] *Ficus religiosa*. For an illustration of the leaf of this tree, see Pl. CLIV, 9.

Several examples of this figure in a tree appear on sealings from Harappā, but without the accessory figures. This sealing from Mohenjo-daro is the only one of its kind that has been found on that site.[1] The nearest approach to this motif in Babylonian art is shown on a seal in the Louvre, where a goddess is pictured beneath a tree that has its top bent over to form a canopy.[2]

Composite animal. No. 3 on Pl. CXVI (SD 1923). Pottery. Formerly coated with a red slip. 1·7 by 0·47 by 0·3 in. Same design on both sides; two signs on the left and an animal on the right, which appears to be the same as the fabulous beasts on seals 377–81. Its tail is straight in the air and it appears to have an elephant's trunk. Level, 6 feet below surface.

Rhinoceros. No. 4 on Pl. CXVI (VS 3063). Pottery. Broken, and a piece missing. Size, (?) by 0·63 by 0·15 in. Indistinct characters on one side and a rhinoceros on the other. Level, 6 feet below surface. From Room 76, House XIII, VS Area.

Unicorn. No. 6 on Pl. CXVI (E 232). Pottery. Size 1·2 by 0·75 by 0·5 in. Face flat; the rounded back and sides of the impression have been carefully smoothed with the fingers. Five characters above a "unicorn". This impression was made with a large seal, but from the way the seal was used, it appears that only the inscription was required. Level, 5 feet below surface. Trial Trench E, DK Area.

No. 10 on Pl. CXVI (HR 1056). Pottery. Coated with a smooth, red slip. Size 1.55 by 0·62 by 0.3 in. On both sides of this impression there is the same scene as on No. 11. Level, 2 feet below surface. Chamber 9, House II, HR Area.

Rhinoceros. No. 11 on Pl. CXVI (VS 3513). Pottery. Coated with a red slip. Size 1·5 by 0·6 by 0·2 in. Both sides alike; a rhinoceros facing to the right and two signs enclosed in brackets (?). Level, 9 feet below surface. From Room 30, House I, VS Area.

No. 12 on Pl. CXVI (VS 928). Faience. A fragment only. Characters on one side. Level, 5 feet below surface. Room 11, House XVIII, Block 4, VS Area.

No. 13 on Pl. CXVI (HR 4275). Pottery. Coated with a red slip. Size 1·55 by 0·65 by 0·2 in. The same scene on both sides as on Nos. 10 and 11. Level, 2 feet below surface. Chamber 25, House XV, Block 3, Section B, HR Area.

No. 15 on Pl. CXVI (HR 4505). Faience. Size 0·95 by 0·4 by 0·15 in. Six very clean-cut characters impressed on one side only. Still bears traces of original colour, either green or blue. Well made and shaped. Level, 3 feet below surface. House XLVIII. Block 6, Section B, HR Area.

No. 16 on Pl. CXVI (HR 5971). Faience. Size 1·8 by 0·55 by 0·3 in. Inscribed on both sides with clear characters. Each inscription is bounded on either side by a band of three vertical lines. Exceptionally well made. Level, 8 feet below surface. Room 87, House IX, Block 2, Section B, HR Area.

No. 19 on Pl. CXVI (E 1449). Faience. Size 1·0 by 0·7 by 0·15 in. Both sides inscribed; four characters visible on one side, other side illegible. Level, 10 feet below surface. Trial Trench E, DK Area.

Gharial. No. 20 on Pl. CXVI (E 2500). Pottery. Size 1·55 by 0·45 by 0·3 in. Slightly rounded ends. One face flat and the other rounded. A gharial, or fish-eating crocodile, on the rounded face, with a fish between its jaws. On the reverse a *svastika* on the left, followed by a tree and three characters. Level, 2 feet below surface. Trial Trench E. DK Area.

[1] A seal illustrated in Pl. XII, 18 and recently found at Mohenjo-daro bears practically the same device. The goat-like animal is not intended to be a sacrifice in the new seal. It is a deity of some kind, for it has a human face.

[2] Ward, *Seal Cylinders of Western Asia*, pp. 149 and 150.

No. 22 on Pl. CXVI (HR 165). Faience. Size, 1·2 by 0·5 by 0·4 in. Both sides are slightly rounded. Four signs on obverse. Reverse blank. Traces of original glaze still remain. Level, 1 ft. 6 in. below surface. Southern end of Deadman Lane, HR Area.

File of animals.

No. 26 on Pl. CXVI (HR 2289). Pottery. Formerly coated with a red slip. Size, 1·75 by 0·65 by 0·3 in. A row of eight characters on one side and a file of animals on the other, the latter very indistinct. Level, 12 ft. 8 in. below surface. Room 127, House X, HR Area.

No. 27 on Pl. CXVI (DK 1323). Faience. Yellow paste inside. Size, 1·2 by 0·3 by 0·35 in. Inscribed on both sides with characters which are now undecipherable. Level, 3 feet below surface. Room 18, Block 4, Section B, DK Area.

Figure in yogi attitude.

No. 29 on Pl. CXVI; Pl. CXVIII, 11 (VS 210). Faience. Size, 1·3 by 0·6 by 0·35 in. On the obverse is a seated figure on a dais,[1] flanked on either side by a kneeling worshipper. Behind each worshipper is a cobra in a vertical position. On the reverse there are five or six characters, some of which are partly obliterated. Level, 2 feet below surface. Lane 5, House XXVII, VS Area.

Not illustrated (HR 3959). Faience. Fragment only. Inscribed on both sides. Still shows traces of blue glaze.

(*b*) *Triangular Prisms*

Five impressions of this shape have been found, one in faience and the remainder in pottery. In four of the examples, all three sides are used for inscriptions or for scenes. Included in this class of sealing are two of slightly different shape.

Ensign bearers.

No. 5 on Pl. CXVI (HR 1443). Pottery. 1·15 inches long, sides 0·36 in. wide. A single row of characters fills up two of the sides of this prism, the upper half of the row being impressed on one side and the lower half on another side. The third side contains a most interesting scene of four men in file, each carrying a standard. Unfortunately, we cannot see what is on three of the standards, but the central standard appears to show the well-known "unicorn". This particular scene is certainly Egyptian in feeling; indeed, if it had been found in that country probably no particular attention would be paid to it. Level, 10 feet below surface. Room 14, House III, HR Area.

Egyptian in character.

Prism sealing.

No. 8 on Pl. CXVI; Pl. CXVIII, 9 (HR 1546). Faience. 1·15 inches long with two sides each 0·5 in. wide, and one side 0·25 in. wide. This prism bears identically the same scene as occurs on No. 5, but it is rather clearer. Evidently both impressions were made from the same seal. Apparently the object carried on the standard behind the one with the unicorn is the basket-like object that always appears in front of this animal. Both these triangular prisms were too small for the seal used upon them, with the result that much interesting detail has been lost. Level, 7 ft. 6 in. below surface. Found in the area between Houses III and VI, in HR Area.

No. 14 on Pl. CXVI; Pl. CXVIII, 10 (Mus. 4). Pottery. Average size of each face, 1·6 inches long by 0.35 in. wide.

Animals in file.

(*a*) On one face, from left to right, there are an elephant, a rhinoceros, a tiger or leopard, and another cat-like animal. Above these animals, which are *en file*, is a fish on the left, followed by a gharial with a fish in its mouth.

[1] The position in which this figure is sitting is typically Indian.

(*b*) From left to right, a file of animals : a unicorn, what seems to be a cow, a short-horned bull, and a rhinoceros. Above the file there appear to be a jungle-fowl and a gharial, but these figures are somewhat indistinct.

(*c*) From left to right, there are two goats eating from a tree, a jungle-fowl, a man apparently pushing a goat or similar animal along, and finally, an antelope-like animal with two heads, similar to those on the copper seals.

A hole, 0.3 in. deep, at each end of this object, suggests that it was used as a kind of revolving bezel. The animals are too close to the ends of the impression for it to have been capped with metal.

Pentagonal impression. No. 17 on Pl. CXVI (HR 5713). Faience. 1·05 inches long. This impression is five-sided, but only one side bears an inscription, which is entirely illegible owing to weathering. Level, 6 feet below surface. Room 43, House LXIV, Block 8, Section B, HR Area.

No. 21 on Pl. CXVI (E 1260). Pottery. 1·65 inches long with sides 0·38 in. wide. On one side there is a row of eight or nine characters ; the other sides are blank. Trial Trench E, DK Area.

Quadrilateral sealing. No. 23 on Pl. CXVI (E 1517). Light-grey pottery. 1·25 inches long by 0·4 in. thick. This prism was evidently first intended to be triangular, but in the removal of waste material in the process of shaping it, it acquired four unequal sides. On three of the sides there are inscriptions in small, fine characters which are difficult to make out. Level, 10 feet below surface. Trial Trench E, DK Area.

Tiger, unicorn and bull. No. 25 on Pl. CXVI ; Pl. CXVIII, 12 (HR 3766). Pottery. Coated with a red slip. 1·3 inches long with sides 0·5 in. wide. Level, 10 feet below surface. House XIV, Block 3, Section B, HR Area.

(*a*) On the left, a tiger, standing over a manger ; three signs on the right.

(*b*) From left to right, a unicorn and three signs.

(*c*) On the left, a short-horned bull standing over a manger ; on the right two signs.

(*c*) *Round Tablets*

Only six seal-impressions were found on rounded tablets, all varying slightly in detail.

No. 7 on Pl. CXVI (C 696). Pottery. 1 inch in diameter and 0·4 in. thick. One side of the object has been stamped with a square seal, and more care was taken to secure the impression of the characters than of the animal. The other side was stamped with a seal of somewhat indefinite design. Level, 8 feet below surface. Chamber 17, Block 12, Section C, DK Area.

No. 9 on Pl. CXVI (E 1450). Yellow sandy paste. 0·7 in. in diameter and 0·32 in. thick. Of the roughest make. Characters on one side, and an animal that cannot be identified on the other. This object seems to have been made in the same mould as No. 24. Level, 10 feet below surface. Trial Trench E, DK Area.

No. 24 on Pl. CXVI (E 1451). Faience. 0·7 in. in diameter and 0·3 in. thick. Roughly shaped and stamped on both sides with a seal. There is an animal that looks like a bear on one side, and a row of five characters on the other. Level, 10 feet below surface. Trial Trench E, DK Area.

Impression of unusual shape. No. 28 on Pl. CXVI ; Pl. CXVIII, 8 (HR 1051). Pottery. 1·5 inches in diameter and 0·7 in. thick. This impression was carefully made in a mould. It is globular in shape with a projecting ring around its equator. On one side is a short-horned bull,

and on the other a rhinoceros. There is a manger in front of each animal. The inscriptions above the animals are not the same. See also Pl. CII, *i* and *j*. Level, 6 feet below surface. From Deadman Lane, HR Area.

Pottery impression. No. 30 on Pl. CXVI (E 444). Pottery. 1·55 inches in diameter and 0·6 in. thick. Very roughly made. The rounded face has been stamped with a square seal. The signs are clear, but it is evident that no trouble was taken to secure a good impression of the unicorn, which can just be seen below the characters. Level, 3 feet below surface. Trial Trench E, DK Area.

Not illustrated (Mus. 11). Yellow sandy paste. 0·7 in. in diameter and 0·3 in. thick. On one side is an animal which it is impossible to identify ; on the other, there is an inscription in four characters which are very faintly marked.

(*d*) *Impressions on Pottery Vessels*

A rectangular seal bearing characters only was used in stamping some of these impressions (e.g., Pl. CXV, 558, 559, and 560). For the impression shown in Pl. LXXVIII, 3, a square seal was evidently employed, but more care was taken to impress the inscription than the animal. The same inscription occurs on two potsherds (Pl. LXXVIII, 3, and Pl. CXV, 560), but it is evident that the same seal was not used for making both impressions. No. 558 (HR 275) in Pl. CXV comes from Courtyard 18, House I, of HR Area, and No. 560 (VS 2269) was found 3 feet below the surface of the ground in a pit dug to the south of House XX, Block 3, VS Area.

Unclassified Impressions

No. 2 on Pl. CXVI (C 2105). Grey pottery. This is a fragment of an impression which is so broken that it could not be placed in any particular group. It is a portion of an inscription in well-preserved characters. Chamber 1, Block 8, Section C, DK Area.

Bronze impression. No. 13 on Pl. CXVIII (Mus. 5). Bronze. A cast of a seal impression measuring 1·8 inches long by 0·25 in. thick. Of very rough work with no attempt whatever at finish. The reverse is blank. Perhaps experimental.

Talismans. That the impressions on baked clay and faience were regarded as talismanic seems likely, though they may also have been ex-votos. One tablet stamped with a seal impression is pierced with very roughly made holes (Pl. CXVI, 1), with the evident purpose of securing it to something, possibly to the clothing. Moreover, all of the tablets which are stamped on one side only have smooth backs, which shows that they had never adhered to anything and, therefore, were not labels for merchandise. Again, many of the objects stamped with seal impressions were inscribed on more than one side, which would be suitable in an amulet but could serve no other purpose. Also some were coated with a red slip, which is never present and would be useless on sealings.

Votive objects. If they were not used as amulets, it is perhaps possible that the objects that have been described were votive offerings. Or they could have been used for either purpose. The fact that no less than three of these objects bear the same impression in addition to being made in the same mould rather suggests their being votive objects. They may have been given by the priest to visitors to a temple, or, as seems more likely, they were bought from the priest as a proof that the visitor had fulfilled certain religious duties, like the embossed cake of sacred earth that is carried away from Kerbela by all devout Shias. Such an object would doubtless be carried on the person.

The fact also that many of the impressions are in faience proves that they were not ordinary sealings. Faience requires a very considerable heat to fuse its glassy coating, which could not, of course, be applied, if it were attached to merchandise.

Animals in file. It is interesting to find that a file of animals is a feature of some of the seal-impressions, for this motif is very common on the archaic Mesopotamian and Susian seals. In place, however, of the antelope and lions that almost invariably figure on the latter seals, we find on the seals of both Mohenjo-daro and Harappā the unicorn, the rhinoceros, the gharial, the short-horned bull, elephant, and tiger.

Prism sealings. The seal impressions on triangular and other prisms are especially interesting as nothing at all similar has been found in Babylonia or Elam. The nearest approach is a triangular seal with figures on all three sides,[1] which was found in the south Kurgan at Anau, and dated to Culture III. Three-sided seals are, of course, well known in Crete and Cappadocia.[2]

Copper Tablets

Curious flat pieces of copper, either rectangular or square in shape, have been found in most parts of the Mohenjo-daro site, chiefly belonging to the Later Periods.

Sizes. The rectangular pieces are of various sizes, ranging from 1·2 by 0·5 in. to 1·5 by 1·0 in. The square pieces, which are rarer, average 0·92 by 0·92 in. in size. These tablets vary greatly in thickness, from 0·07 in. to 0·12 in. One especially substantial tablet (HR 4799) measures 0·85 in. square by 0·23 in. thick.

Owing to the salty nature of the soil of Mohenjo-daro, a large number of these copper tablets are in bad condition, and it has been found impossible, even after cleaning, to make out the animals or the signs upon some of them.

Incised designs. On most of the tablets there is the figure of an animal on one side, and on the other three or more signs forming an inscription. The figures and signs were in every case carefully cut with a burin, but, except in a few cases, corrosion has entirely filled up the incisions with cuprous oxide, making the figures and inscriptions only legible in a reflected light. For this reason none of the tablets could be satisfactorily photographed and only a selected few were sufficiently clear to be drawn. The best preserved are illustrated in Pls. CXVII and CXVIII.

Finish. The majority of the tablets are well made, and all seem to have been cast first and hammered smooth afterwards. In some cases they were trimmed remarkably true, with smooth faces, sides, and ends. In other cases they are rough and jagged at one end, which suggests that they were snapped off from a longer piece. In rare instances the ends are slightly rounded.

Classification. The tablets fall into two classes :—

(*a*) Those with an animal or human figure on one side and an inscription on the other.
(*b*) Those with an inscription on each side.

Class (*a*) are the more numerous and, moreover, are usually of rougher make.

Out of a total number of eighty copper tablets found, forty-seven belong to class (*a*) and nine to class (*b*). Twenty-four tablets are more or less illegible, but there is certainly an inscription on one side, whatever the other side may contain.

[1] Pumpelly, *Explorations in Turkestan*, vol. i, p. 169, No. 400.

[2] Evans, *Palace of Minos*, vol. i, pp. 68–9. They are found as early as E.M. I. In shape they resemble the prisms from Mohenjo-daro, but it must be noted that the latter are in every case unperforated and are sealings, not seals.

The animals on the tablets always face to the right, except the antelopes, which are represented as looking backwards over their shoulders.

List of animals. Below is a list of the animals on the legible tablets with the numbers found, up to the present, of each :—

	Examples.
Elephant	6
Antelope	5
Hare	5
Rhinoceros	4
Buffalo (?)	4
Short-horned bull	4
Human figure	3
Goat	2
Brahmani bull	2
Tiger	2
Two-headed animal	2
Composite animal	1
Monkey (?)	1

The animals with long tails and curly horns have been provisionally classed with the buffaloes. The three tablets with human figures are similar to that illustrated in Pl. CXVII, 16. One tablet seems to bear the figure of a monkey, but this was too indistinct to be drawn. The above list shows that most of the animals that appear on the seals are also represented on the copper tablets. There are, however, several additional animals, viz. the hare, a double-headed animal, and the monkey, if indeed the last is what it seems to be.

Hare. The addition of the hare is somewhat surprising, as most of the animals are large and powerful, and therefore the more likely to have developed into divinities. The addition of the hare, however, suggests that, as in ancient Egypt, the lesser animals also were objects of worship.

The hare is always drawn in a crouching attitude with a small tuft of grass in front of it, as if it were feeding (Pl. CXVII, 5 and 6). The hare is not worshipped[1] in India to-day, but it is one of the animals into which Buddha entered in one of his previous existences. One of the black spots in the moon is termed a hare in India and China, although the animal is not associated with lunar worship. No. 6 was found in Block 2, Section C, DK Area. Level, 6 feet.

Composite animal. There is a composite animal on one tablet only (VS 3590). It has the hind-quarters of a rhinoceros and the fore-quarters of a leopard or tiger. It also has the unicorn's horn, and a manger stands before it (Pl. CXVIII, 2).

A very curious animal on two of the tablets appears to have the body of an antelope with a head at either end. The fact that more than one example has been found of this animal proves that it is not a vagary of the engraver (Pl. CXVII, 3).

Hunter. The tablet bearing the figure of a man dressed in what seems to be a costume of leaves is exceptionally interesting (Pl. CXVII, 16). He is apparently a hunter armed with a bow and arrow, and he is clearly thus attired to enable him to get close to his quarry.[2] Another tablet (E 2215), which is, unfortunately, in a very bad state of preservation, bears the same

[1] Cf. p. 71 *supra*.—[Ed.]

[2] The horns on his head indicate that he is a divine hunter. See *supra*, p. 67.—[Ed.]

design, but it is not certain whether the garment here is of leaves. The first tablet was unearthed from Room 1, House XVIII, VS Area, and the second comes from 3 feet below the surface in Trial Trench E, DK Area.

Monkey. As stated above, there appears to be a monkey on one of the tablets, but the latter is in such a bad condition that the question of the animal represented must be regarded as uncertain. The monkey, however, is represented in several models in faience, pottery, and paste (Pl. XCVI, 11, 12, and 13).

Antelope. The antelope appears on five of the tablets, represented in a typical attitude with his head turned to look behind him (Pl. CXVII, 1 and 2 ; Pl. CXVIII, 1). This attitude is very common in Elamitic art,[1] especially on the pottery and seals. The position is also well known on both the archaic seals and pottery of Mesopotamia.

Elephant. For the present, the elephant appears to take first place amongst the animals on these copper tablets. An excellent example is seen in Pl. CXVII, 11, of which the original was found at a depth of 1 foot below the surface in House XXVI, VS Area. Figures of the elephant are always roughly executed, unlike the careful carvings on the steatite seals, even though there mistakes were sometimes made in their portrayal.

Bull. The short-horned bull is rarely depicted on these tablets, but one particularly good example is shown in Pl. CXVII, 13. This tablet was unearthed from Chamber 22, Block 4, of the L Area, and is dated, like the rest of the tablets, to the Late Period. The humped bull, but with short horns, is pictured on tablet No. 14 in the same plate. This last comes from Structure XXXIX, Block 5, of the HR Area, and was found at a level of 3 feet below the surface of the ground.

Tiger. The tiger is only twice represented. The best example of this animal is shown in Pl. CXVII, 4. The position of the pictographs above the animal is very unusual for an inscription on these copper tablets. This particular tablet comes from Chamber 27, Block 4, of L Area.

Unknown animal. The exceptionally powerful-looking animal with long curling horns (Pl. CXVII, 8 and 12, and Pl. CXVIII, 4 and 6), and with a manger placed in front of it, does not appear on any of the seals. The long tail of the animal with a tuft at the end is carried well in the air, as if the creature were about to charge. Tablet 8 in Pl. CXVII was found in Room 107, House XVI, VS Area, and tablet 6, Pl. CXVIII, comes from the pillared hall, Block 4, of the L Area. Tablet No. 12 was recovered from Court 39, House XVII, Block 3, of HR Area.

The rope pattern on the obverse of Tablet No. 5 in Pl. CXVIII is unique at Mohenjo-daro.[2] This tablet was unearthed from Room 30, House I, VS Area.

Inscriptions and animals. The fact that all of the tablets bearing the representation of a hare have the same inscription on the obverse (Pl. CXVII, 5 and 6), and that the animals with long curling horns and long tail[3] also bear the same inscription—different, however, from the inscription on the hare tablets (Pl. CXVII, 8 and 12)—suggests that in some cases at least the inscription on the tablet refers in some way to the animal on the tablet. Of three tablets, each with an elephant engraved upon it, all bear the same inscription (Pl. CXVII, 11), and lastly, those

[1] *Mém. Dél. en Perse*, t. xiii, p. 43, figs. 143, 144.

[2] Compare this pattern with one on an Egyptian vase of predynastic date. *Ancient Egypt*, 1928, pt. iii, p. 69, fig. 2. Cord designs were frequently used by the early Sumerians on their seals, especially in the archaic period. *Oxford Editions of Cuneiform Texts*, vol. vii, pl. xxix.

[3] It is difficult to identify this animal. The Director of the Zoological Survey of India suggests that it may be a buffalo (*Bos bubalis*). It, however, bears no resemblance to the undoubted buffalo that is represented on three of the steatite seals (Nos. 304–6).

with the figures of antelopes looking backwards over their shoulders all have the same characters on the reverse (Pl. CXVII, 1 and 2; Pl. CXVIII, 1).[1]

Captive animals. Some, if not all the animals on the copper tablets were possibly dedicated to certain gods. As on some of the seals, we find a manger placed before certain of them, as, for instance, the unicorn, the rhinoceros, antelope, and Brahmanī bull. This suggests that these animals were kept in captivity, and, if so, it is likely to have been for religious purposes; a rhinoceros is obviously quite useless for any domestic purpose. A manger is placed before the composite animal on the tablet illustrated in Pl. CXVIII, 2, despite the fact that such an animal could never have existed.[2]

Use of tablets. It would be difficult to use these tablets as seals on account of their being so thin, and not deeply enough incised. Moreover, none is perforated for threading on a cord. They were probably used as amulets, wrapped up in some material and worn round the neck or wrist, or sewn to the clothing. This would account for the rough finish of some of them, for if worn in this way they would not have been exposed to view. It is possible that the possession of one of these amulets placed the wearer under the especial protection of the deity whose particular animal was engraved upon it. On the other hand, the animals may not have been regarded as sacred, but simply as possessed of a special attribute of which the wearer hoped to avail himself. For example, the hare has the quality of great speed, and the wearer of a copper tablet with a figure of this animal upon it perhaps thought himself more speedy for that reason. Even at the present day in India, mothers who think their children lack certain qualities provide them with amulets to overcome the defect, and these amulets are frequently worn through life. On the whole, however, it seems more probable that the animals on the copper tablets were definitely symbols of certain deities, and that the wearers of these emblems wished for the patronage of the particular deity symbolized thereon.

[1] The second sign in the tablet illustrated on Pl. CXVII, 2, may possibly be incorrect. The artist had great difficulty in making out the signs on this particular object.

[2] Unless this badly drawn animal is meant to be a rhinoceros!

Plate No.	Size in Inches.	Level below Surface.	Type.	Materials and Colour.			Site and Serial No.
				Steatite.	Faience.	Pottery.	
1	2·1 × 1·5	3′ 0″	B.	Wh.	—	—	HR 4161
2	1·8 × 1·8	4′ 2″	B.	Wh.	—	—	E 1187
3	1·85 × 1·85	2′ 0″	B.	Wh.	—	—	VS 823
4	1·8 × 1·8	3′ 0″	B.	Wh.	—	—	HR 582
5	1·0 × ?	7′ 0″	B.	Wh.	—	—	HR 3336
6	1·9 × 1·9	2′ 0″	B.	Wh.	—	—	HR 164
7	0·7 × 0·7	3′ 0″	B.	Wh.	—	—	HR 4110
8	2·0 × 2·0	3′ 0″	B.	Wh.	—	—	HR 743
9	2·5 × 2·5	2′ 0″	B.	Wh.	—	—	C 1895
10	2·1 × 2·1	3′ 0″	B.	Wh.	—	—	HR 4601
11	2·25 × 2·25	5′ 0″	B.	Wh.	—	—	C 194
12	1·85 × 1·85	1′ 6″	B.	Wh.	—	—	C 2691
13	0·85 × ?	2′ 6″	B.	Wh.	—	—	HR 1575
14	1·3 × ?	3′ 0″	B.	Wh.	—	—	DK 315
15	2·1 × 2·1	1′ 6″	B.	Wh.	—	—	VS 1329
16	2·35 × 2·35	3′ 0″	B.	Wh.	—	—	VS 1037
17	2·25 × ?	3′ 0″	B.	Wh.	—	—	HR 4568
18	2·7 × 2·7	2′ 0″	B.	Wh.	—	—	HR 5804
19	1·35 × 1·35	5′ 0″	B.	Wh.	—	—	VS 1799
20	1·4 × 1·4	4′ 9″	B.	Wh.	—	—	SD 1911
21	1·45 × 1·45	3′ 6″	B.	Wh.	—	—	VS 1469
22	1·4 × 1·4	Sur.	B.	Wh.	—	—	L 5
23	1·45 × 1·5	9′ 0″	B.	Wh.	—	—	HR 3730
24	1·4 × 1·4	6′ 4″	B.	Wh.	—	—	VS 2328
25	1·45 × 1·45	2′ 0″	B.	Wh.	—	—	DK 1528
26	0·9 × ?	8′ 9″	B.	Wh.	—	—	SD 1839
27	1·85 × ·45	5′ 0″	B.	Wh.	—	—	VS 1573
28	1·4 × 1·4	3′ 6″	B.	Wh.	—	—	DK 2484
29	1·35 × 1·35	5′ 0″	B.	Wh.	—	—	HR 4868
30	1·65 × 1·6	Sur.	B.	Wh.	—	—	HR 167
31	1·6 × 1·6	5′ 0″	B.	Wh.	—	—	HR 5414
32	1·5 × ?	5′ 0″	B.	Wh.	—	—	HR 5030
33	1·8 × 1·8	6′ 6″	B.	Wh.	—	—	HR 2025
34	2·1 × ?	2′ 6″	B.	Wh.	—	—	C 181
35	1·45 × 1·45	5′ 0″	B.	Wh.	—	—	HR 2723
36	1·55 × 1·55	5′ 9″	B.	Wh.	—	—	F 46
37	1·65 × 1·65	1′ 0″	B.	Wh.	—	—	DK 402
38	2·5 × 2·5	2′ 6″	B.	Wh.	—	—	VS 2040
39	1·7 × 1·7	2′ 1″	B.	Wh.	—	—	VS 349
40	1·5 × 1·5	3′ 6″	B.	Wh.	—	—	D 187
41	1·35 × 1·35	3′ 11″	B.	Wh.	—	—	VS 2652
42	1·4 × 1·4	2′ 0″	B.	Wh.	—	—	HR 4356
43	1·3 × 1·3	5′ 5″	B.	Wh.	—	—	C 841
44	1·2 × 1·2	1′ 6″	B.	Wh.	—	—	DK 2055
45	1·25 × 1·25	2′ 6″	B.	Wh.	—	—	DK 188
46	1·25 × 1·25	3′ 6″	B.	Wh.	—	—	DK 2485
47	1·2 × 1·2	6′ 0″	B.	Wh.	—	—	VS 3414
48	1·15 × 1·15	3′ 0″	B.	Wh.	—	—	HR 4076
49	1·4 × 1·4	1′ 6″	B.	Wh.	—	—	DK 108
50	1·3 × 1·3	6′ 0″	B.	Wh.	—	—	HR 5085
51	1·35 × 1·35	6′ 0″	B.	Wh.	—	—	HR 4945
52	1·3 × 1·25	3′ 0″	B.	Wh.	—	—	HR 5629
53	1·25 × 1·25	3′ 0″	B.	Wh.	—	—	HR 629
54	1·4 × 1·4	5′ 0″	B.	Wh.	—	—	VS 3594
55	1·2 × 1·2	5′ 0″	B.	Wh.	—	—	DK 3069
56	—	—	—	—	—	—	BJ 2
57	1·4 × 1·4	9′ 0″	B.	Wh.	—	—	DM 189
58	1·3 × 1·3	8′ 0″	B.	Wh.	—	—	HR 2582
59	1·25 × ?	7′ 0″	B.	Wh.	—	—	E 2401
60	1·25 × 1·3	3′ 0″	B.	Wh.	—	—	C 3070
61	1·5 × 1·5	11′ 0″	B.	Wh.	—	—	HR 1694
62	—	—	—	—	—	—	BJ 3
63	1·65 × ?	11′ 0″	B.	Wh.	—	—	HR 1695
64	1·6 × ?	14′ 0″	B.	Wh.	—	—	HR 2466
65	1·5 × 1·5	4′ 0″	B.	Wh.	—	—	HR 5320
66	1·75 × 1·75	3′ 6″	B.	Wh.	—	—	VS 1059
67	1·85 × 1·85	10′ 0″	B.	Wh.	—	—	HR 2406
68	1·45 × 1·40	1′ 0″	B.	Wh.	—	—	D 21
69	1·6 × 1·6	3′ 0″	B.	Wh.	—	—	HR 640
70	1·2 × 1·2	5′ 2″	B.	Wh.	—	—	VS 2664
71	—	—	—	—	—	—	BJ 4
72	1·15 × 1·15	1′ 11″	B.	Wh.	—	—	DK 33
73	1·1 × 1·1	3′ 0″	B.	Wh.	—	—	C 3191
74	1·15 × 1·15	5′ 0″	B.	Wh.	—	—	DK 1541
75	1·1 × 1·1	7′ 0″	B.	Wh.	—	—	DK 2130
76	1·1 × 1·1	3′ 9″	B.	Wh.	—	—	C 3055
77	1·1 × 1·1	7′ 0″	B.	Wh.	—	—	C 2768
78	1·1 × 1·1	5′ 6″	B.	Wh.	—	—	E 1345
79	0·6 × 0·6	3′ 0″	B.	Wh.	—	—	E 1585
80	1·1 × 1·1	1′ 0″	B.	Wh.	—	—	HR 262
81	1·2 × 1·25	3′ 0″	B.	Wh.	—	—	DK 2198
82	1·35 × ?	3′ 3″	B.	Wh.	—	—	HR 2371
83	1·2 × 1·2	1′ 0″	B.	Wh.	—	—	DK 12
84	1·2 × 1·15	12′ 0″	B.	Wh.	—	—	SD 1930
85	1·5 × 1·5	1′ 0″	B.	Wh.	—	—	VS 1819
86	1·1 × 1·1	2′ 0″	B.	Wh.	—	—	HR 2863
87	1·3 × 1·3	6′ 0″	B.	Wh.	—	—	DK 2220
88	1·15 × 1·15	1′ 3″	B.	Wh.	—	—	VS 1
89	1·0 × 1·0	4′ 0″	B.	Wh.	—	—	VS 3332
90	1·2 × 1·25	2′ 1″	B.	Wh.	—	—	VS 47
91	1·25 × 1·3	5′ 6″	B.	Wh.	—	—	DK 2147
92	1·05 × 1·05	3′ 0″	B.	Wh.	—	—	HR 4411
93	—	—	—	—	—	—	BJ 4
94	1·15 × 1·15	8′ 0″	B.	Wh.	—	—	B 426
95	1·3 × 1·3	1′ 3″	B.	Wh.	—	—	DK 92
96	1·25 × 1·25	—	B.	Wh.	—	—	HR 4625a
97	1·2 × 1·2	2′ 0″	B.	Wh.	—	—	HR 4385
98	1·25 × 1·25	3′ 0″	B.	Wh.	—	—	E 829
99	1·15 × 1·15	2′ 1″	B.	Wh.	—	—	VS 49
100	1·15 × ?	10′ 0″	B.	Wh.	—	—	SD 2010
101	1·3 × 1·3	3′ 0″	B.	Wh.	—	—	DK 1522
102	1·35 × 1·35	Sur.	B.	Wh.	—	—	HR 4560
103	1·15 × 1·15	Sur.	B.	Wh.	—	—	HR 683
104	1·0 × 1·0	5′ 0″	B.	Wh.	—	—	VS 1779
105	1·0 × 1·0	6′ 0″	B.	Wh.	—	—	SD 2445
106	0·85 × 0·85	3′ 0″	B.	Wh.	—	—	HR 4238
107	1·1 × 1·1	7′ 0″	B.	Wh.	—	—	E 296
108	1·0 × 1·0	6′ 0″	B.	Wh.	—	—	DK 596
109	1·1 × 1·1	1′ 3″	B.	Wh.	—	—	E 230
110	0·9 × 0·9	3′ 0″	B.	Wh.	—	—	HR 4111
111	—	6′ 0″	B.	Wh.	—	—	SD 1850
112	1·2 × ?	—	B.	Wh.	—	—	E 2548
113	1·05 × 1·05	3′ 0″	B.	Wh.	—	—	DK 962
114	1·0 × 1·0	6′ 0″	B.	Wh.	—	—	HR 4965
115	1·15 × 1·15	3′ 0″	B.	Wh.	—	—	E 470
116	1·1 × 1·1	6′ 0″	B.	Wh.	—	—	DM 67
117	1·15 × 1·2	7′ 0″	B.	Wh.	—	—	VS 3595
118	1·05 × 1·05	8′ 0″	B.	Wh.	—	—	SD 570
119	1·05 × 1·05	6′ 0″	B.	Wh.	—	—	VS 2989
120	1·15 × 1·15	—	C.	—	—	P.	HR 4264
121	1·1 × 1·1	5′ 8″	B.	Wh.	—	—	VS 2542
122	1·1 × 1·1	4′ 6″	B.	Wh.	—	—	D 316
123	1·0 × 1·0	2′ 4″	B.	Wh.	—	—	HR 3732a
124	—	9′ 0″	B.	Wh.	—	—	HR 5700
125	1·0 × 1·0	5′ 0″	B.	Wh.	—	—	E 2484a
126	1·0 × 1·0	7′ 0″	B.	Wh.	—	—	HR 3207
127	1·05 × 1·05	2′ 5″	B.	Wh.	—	—	HR 4368
128	1·1 × 1·1	11′ 0″	B.	Wh.	—	—	VS 778
129	1·4 × ·6	1′ 0″	B.	Wh.	—	—	E 1094
130	1·05 × 1·05	2′ 6″	B.	Wh.	—	—	VS 1468
131	1·05 × 1·05	5′ 0″	B.	Wh.	—	—	VS 3391
132	1·2 × 1·2	3′ 9″	B.	Wh.	—	—	D 552
133	1·05 × 1·05	4′ 0″	B.	Wh.	—	—	B 383
134	1·1 × 1·1	—	B.	Wh.	—	—	E 2767
135	1·15 × 1·15	—	B.	Wh.	—	—	HR 2973
136	1·05 × 1·05	3 6″	B.	Bl.	—	—	C 329
137	? × 0·4	18′ 0″	B.	Wh.	—	—	VS 3154
138	1·25 × ?	2′ 8″	B.	Wh.	—	—	HR 4986
139	1·45 × ?	6′ 0″	B.	Wh.	—	—	HR 5531
140	1·2 × 1·2	7′ 0″	B.	Wh.	—	—	DK 3279

Plate No.	Size in Inches.	Level below Surface.	Type.	Materials and Colour. Steatite.	Faience.	Pottery.	Site and Serial No.
141	1·0 × 1·0	5′ 6″	B.	Wh.	—	—	HR 1950
142	1·35 × 1·35	1′ 6″	B.	Wh.	—	—	DK 3094
143	0·8 × 0·8	?	B.	Wh.	—	—	HR 4057
144	0·9 × ?	6′ 0″	B.	Wh.	—	—	HR 5076
145	0·3 × ?	2′ 6″	B.	Wh.	—	—	DK 2971
146	1·0 × 1·0	2′ 9″	B.	Wh.	—	—	E 845
147	0·9 × 0·9	2′ 6″	B.	Wh.	—	—	DK 221
148	0·9 × 0·9	5′ 6″	B.	Wh.	—	—	VS 1961
149	0·95 × 0·95	2′ 0″	B.	Wh.	—	—	HR 4384
150	0·9 × 0·9	1′ 4″	B.	Wh.	—	—	C 3155
151	1·05 × 1·05	5′ 0″	B.	Wh.	—	—	HR 5995
152	0·3 × ?	—	B.	Wh.	—	—	C 392
153	0·31 × ?	2′ 0″	B.	Wh.	—	—	A 274
154	0·85 × 0·85	3′ 1″	B.	Wh.	—	—	VS 90
155	0·85 × 0·85	3′ 0″	B.	Wh.	—	—	DK 1892
156	1·0 × 1·0	12′ 6″	B.	Wh.	—	—	HR 2522
157	1·0 × 1·0	3′ 6″	B.	Wh.	—	—	VS 1666
158	0·95 × 0·95	4′ 7″	B.	Wh.	—	—	DM 50
159	1·05 × 1·05	4′ 6″	B.	Wh.	—	—	E 491
160	1·0 × 1·0	9′ 0″	B.	Wh.	—	—	E 1809
161	1·05 × 1·05	4′ 0″	B.	Wh.	—	—	HR 5630
162	1·0 × 1·0	3′ 0″	B.	Wh.	—	—	HR 4291
163	0·85 × 0·85	4′ 0″	B.	Wh.	—	—	VS 3389
164	1·15 × 0·35	5′ 0″	B.	Wh.	—	—	HR 398
165	—	5′ 6″	B.	Wh.	—	—	C 206
166	0·9 × 0·9	3′ 0″	B.	Wh.	—	—	HR 4635
167	0·85 × 0·85	4′ 0″	B.	Wh.	—	—	HR 5311
168	1·1 × 1·1	6′ 0″	B.	Wh.	—	—	HR 3791
169	0·95 × 0·95	7′ 0″	B.	Wh.	—	—	C 810
170	1·05 × ?	5′ 6″	B.	Wh.	—	—	E 2053
171	0·8 × 0·8	3′ 0″	B.	Wh.	—	—	HR 5703
172	1·1 × 1·1	3′ 0″	B.	Wh.	—	—	VS 2372
173	0·95 × 0·95	3′ 6″	B.	Wh.	—	—	HR 4994
174	0·9 × 0·9	4′ 0″	B.	Wh.	—	—	HR 3277
175	1·35 × 0·3	3′ 0″	B.	Wh.	—	—	VS 1558
176	1·2 × 1·2	2′ 0″	B.	Wh.	—	—	E 96
177	1·2 × 1·2	5′ 0″	B.	Wh.	—	—	VS 2541
178	1·2 × ?	4′ 0″	B.	Wh.	—	—	E 1521
179	1·0 × 1·0	6′ 0″	B.	Wh.	—	—	SD 1553
180	1·05 × 1·05	6′ 0″	B.	Wh.	—	—	C 3133
181	1·05 × 1·05	10′ 0″	B.	Wh.	—	—	SD 1731
182	1·1 × 1·1	6′ 6″	B.	Wh.	—	—	C 2394
183	1·0 × 1·0	?	B.	Wh.	—	—	HR 2268
184	—	5′ 0″	B.	Wh.	—	—	HR 4873
185	1·05 × 0·30	2′ 6″	B.	Wh.	—	—	E 2006
186	1·15 × 1·15	3′ 0″	B.	Wh.	—	—	E 1008
187	1·05 × 1·1	6′ 0″	B.	Wh.	—	—	E 2217
188	1·05 × 1·05	3′ 0″	B.	Bl.	—	—	HR 4519
189	0·95 × 0·95	5′ 3″	B.	Wh.	—	—	C 2023
190	1·0 × 1·05	3′ 0″	B.	Wh.	—	—	C 3024
191	—	2′ 6″	B.	Wh.	—	—	VS 235
192	0·8 × 0·8	3′ 5″	C.	Wh.	—	—	VS 272
193	0·8 × 0·8	5′ 0″	B.	Wh.	—	—	DK 744
194	0·8 × 0·8	8′ 6″	B.	Wh.	—	—	C 2114
195	0·6 × 0·6	—	B.	Wh.	—	—	HR 4622
196	0·85 × ?	2′ 0″	B.	Wh.	—	—	DK 925
197	0·8 × 0·8	2′ 9″	B.	Wh.	—	—	C 3202
198	0·75 × 0·75	6′ 0″	B.	Wh.	—	—	E 1912
199	0·85 × 0·85	2′ 6″	B.	Wh.	—	—	C 2803
200	0·75 × 0·75	7′ 4″	B.	Wh.	—	—	HR 1451
201	0·85 × 0·85	2′ 0″	B.	Wh.	—	—	HR 4400
202	0·8 × 0·8	4′ 0″	B.	Wh.	—	—	HR 5607
203	0·75 × 0·75	4′ 0″	B.	Wh.	—	—	HR 5261
204	0·8 × 0·8	4′ 6″	B.	Wh.	—	—	C 435
205	0·85 × 0·85	4′ 3″	B.	Wh.	—	—	D 289
206	0·85 × 0·85	4′ 0″	B.	Wh.	—	—	HR 5596
207	0·75 × 0·75	3′ 0″	B.	Wh.	—	—	HR 4124
208	0·9 × 0·9	4′ 0″	B.	Wh.	—	—	HR 5597
209	0·95 × ?	4′ 6″	B.	Wh.	—	—	VS 3359
210	—	—	—	—	—	—	BJ 10
211	1·0 × ?	2′ 0″	B.	Wh.	—	—	HR 4585
212	0·6 × 0·6	2′ 0″	B.	Wh.	—	—	C 2692
213	0·7 × 0·7	4′ 0″	B.	Wh.	—	—	HR 5594
214	0·8 × 0·85	6′ 0″	B.	Wh.	—	—	HR 5057
215	0·85 × 0·85	2′ 0″	B.	Wh.	—	—	E 1154
216	1·0 × ?	2′ 0″	B.	Wh.	—	—	HR 2869
217	0·85 × 0·85	5′ 6″	B.	Wh.	—	—	VS 2374
218	0·85 × 0·85	—	B.	Wh.	—	—	HR 5789
219	0·85 × 0·85	5′ 0″	B.	Wh.	—	—	DK 1519
220	0·85 × 0·85	3′ 0″	B.	Wh.	—	—	E 653
221	0·85 × 0·85	4′ 0″	B.	Wh.	—	—	HR 6098
222	0·75 × 0·75	5′ 0″	B.	Wh.	—	—	HR 5856
223	—	6′ 0″	B.	Wh.	—	—	HR 5146
224	0·8 × 0·8	4′ 0″	B.	Wh.	—	—	HR 1951
225	0·9 × 0·9	3′ 0″	B.	Wh.	—	—	VS 2262
226	0·8 × 0·8	3′ 6″	B.	Wh.	—	—	HR 4872
227	0·9 × 0·9	2′ 0″	C.	Wh.	—	—	L 323
228	0·9 × 0·9	10′ 0″	B.	Wh.	—	—	B 608
229	0·85 × 0·85	4′ 6″	B.	Wh.	—	—	E 187
230	0·9 × 0·9	2′ 0″	C.	Wh.	—	—	L 323
231	0·95 × 0·95	1′ 0″	B.	Wh.	—	—	HR 4436
232	0·85 × 0·85	3′ 0″	B.	Wh.	—	—	DK 1892
233	0·85 × 0·85	3′ 0″	B.	Wh.	—	—	D 619
234	0·9 × 0·9	5′ 0″	B.	Wh.	—	—	L 742
235	0·9 × 0·9	6′ 6″	B.	Wh.	—	—	E 297
236	1·0 × 1·0	4′ 7″	B.	Wh.	—	—	HR 1365
237	0·75 × 0·75	2′ 0″	B.	Wh.	—	—	HR 5516
238	1·0 × ?	6′ 0″	B.	Wh.	—	—	HR 1673
239	1·05 × ?	6′ 0″	B.	Wh.	—	—	HR 3792
240	0·95 × 0·95	2′ 0″	B.	Wh.	—	—	HR 4386
241	—	4′ 0″	B.	Wh.	—	—	HR 5648
242	1·1 × ?	5′ 0″	B.	Wh.	—	—	L 476
243	0·85 × 0·85	2′ 0″	B.	Wh.	—	—	VS 505
244	—	—	—	—	—	—	BJ 5
245	0·95 × 0·95	5′ 6″	B.	Wh.	—	—	HR 5310
246	1·0 × 1·0	3′ 0″	B.	Wh.	—	—	HR 3506
247	0·95 × ?	3′ 0″	B.	Wh.	—	—	HR 2595
248	—	—	—	—	—	—	BJ 6
249	0·85 × 0·85	1′ 6″	B.	Wh.	—	—	C 2327
250	? × 1·6	5′ 6″	B.	Wh.	—	—	VS 2582
251	0·95 × 0·95	2′ 0″	B.	Wh.	—	—	HR 5699
252	0·95 × 0·95	3′ 0″	B.	Wh.	—	—	HR 2596
253	0·85 × 0·85	3′ 0″	B.	Wh.	—	—	HR 4492
254	0·9 × 0·9	5′ 0″	B.	Wh.	—	—	DK 160
255	—	1′ 2″	B.	Wh.	—	—	HR 3010
256	0·9 × 0·9	3′ 0″	B.	Wh.	—	—	HR 4112
257	1·0 × 1·0	7′ 0″	B.	Wh.	—	—	HR 5772
258	—	6′ 0″	B.	Wh.	—	—	HR 5251
259	—	3′ 0″	B.	Wh.	—	—	DK 2027
260	0·4 × ?	1′ 3″	B.	Wh.	—	—	DK 91
261	0·8 × 0·8	5′ 6″	B.	Wh.	—	—	E 268
262	0·85 × 0·85	4′ 0″	B.	Wh.	—	—	C 3201
263	—	2′ 0″	B.	Wh.	—	—	HR 2912
264	? × 0·85	5′ 0″	B.	Wh.	—	—	L 661
265	1·0 × 0·3	5′ 0″	B.	Wh.	—	—	E 2484
266	0·65 × 0·65	4′ 6″	B.	Wh.	—	—	HR 4409
267	0·5 × 0·5	2′ 0″	B.	Wh.	—	—	E 2094
268	0·6 × 0·6	3′ 6″	C.	Wh.	—	—	C 162
269	0·6 × 0·6	16′ 0″	B.	Wh.	—	—	B 650
270	0·5 × 0·5	4′ 0″	B.	Wh.	—	—	C 2372
271	—	5′ 0″	B.	Wh.	—	—	B 434
272	0·5 × 0·5	B.P.	B.	Wh.	—	—	L 316
273	0·6 × 0·6	10′ 0″	B.	Wh.	—	—	DK 2294
274	0·63 × 0·6	5′ 0″	B.	Wh.	—	—	C 1863
275	0·6 × 0·2	3′ 0″	B.	Wh.	—	—	L 899
276	—	—	B.	Wh.	—	—	HR 4244
277	0·6 × 0·6	1′ 0″	C.	Wh.	—	—	E 250
278	0·55 × 0·55	9′ 0″	B.	Wh.	—	—	VS 2518?
279	0·65 × 0·70	2′ 0″	B.	Wh.	—	—	DK 1510
280	?	4′ 0″	B.	Wh.	—	—	HR 5589

Plate No.	Size in Inches.	Level below Surface.	Type.	Materials and Colour.			Site and Serial No.
				Steatite.	Faience.	Pottery.	
281	0·8 × ?	3′ 0″	B.	Wh.	—	—	E 1829
282	0·75 × 0·25	5′ 2″	B.	Wh.	—	—	C 2766
283	0·5 × 0·5	2′ 5″	B.	Wh.	—	—	HR 4054
284	? × 0·9 × ?	4′ 0″	B.	Wh.	—	—	C 3035
285	0·7 × 0·7	4′ 0″	B.	Wh.	—	—	HR 1804
286	0·7 × 0·7	2′ 4″	B.	Wh.	—	—	HR 37326
287	0·75 × 0·75	3′ 6″	B.	Wh.	—	—	C 1956
288	0·75 × 0·75	4′ 0″	B.	Wh.	—	—	C 2823
289	0·9 × ?	6′ 0″	B.	Wh.	—	—	D 90
290	—	7′ 0″	B.	Wh.	—	—	E 348
291	—	2′ 6″	?	Wh.	—	—	VS 2852
292	0·7 × 0·7	3′ 0″	B.	Wh.	—	—	E 388
293	0·85 × ?	4′ 0″	B.	Wh.	—	—	HR 4629
294	1·1 × 1·1	2′ 0″	B.	Wh.	—	—	DK 1512
295	0·7 × 0·7	—	B.	Wh.	—	—	VS 3172
296	0·75 × ?	7′ 0″	B.	Wh.	—	—	E 976
297	—	—	—	—	—	—	BJ 8
298	—	6′ 0″	B.	Wh.	—	—	HR 3841
299	—	4′ 0″	B.	Wh.	—	—	HR 5788
300	0·35 × ?	6′ 0″	B.	Wh	—	—	E 323
301	0·25 × ?	5′ 3″	B.	Wh.	—	—	C 2024
302	0·95 × 0·9	2′ 2″	B.	Wh.	—	—	DK 3205
303	0·95 × 0·95	5′ 0″	B.	Wh.	—	—	C 290
304	1·0 × 1·0	Sur.	B.	Wh.	—	—	L 385
305	0·75 × 0·75	3′ 0″	B.	Wh.	—	—	HR 5225
306	1·1 × 1·05	5′ 0″	B.	Wh.	—	—	HR 5193
307	0·95 × 0·95	4′ 0″	B.	Wh.	—	—	L 351
308	0·8 × 0·8	?	B.	Wh.	—	—	C 2767
309	0·9	4′ 0″	H.	Wh.	—	—	HR 4393
310	0·85 × 0·85	8′ 0″	B.	Wh.	—	—	DK 1542
311	0·8 × 0·8	—	C.	Wh.	—	—	HR 4503
312	0·95 × 0·95	6′ 0″	B.	Wh.	—	—	VS 3503
313	0·30 × ?	2′ 0″	B.	—	—	—	VS 2543
314	1·0 × 1·0	3′ 0″	B.	Wh.	—	—	VS 1754
315	1·05 × 1·05	2′ 4″	B.	Wh.	—	—	VS 59
316	1·2 × ?	4′ 0″	B.	Wh.	—	—	L 904
317	1·1 × 1·1	3′ 0″	B.	Wh.	—	—	HR 583
318	1·15 × 0·35	3′ 6″	B.	Wh.	—	—	HR 4364
319	1·05 × 1·05	10′ 0″	B.	Wh.	—	—	HR 5949
320	0·85 × 0·85	5′ 0″	B.	Wh.	—	—	HR 1793
321	1·6 × 1·6	4′ 0″	B.	Wh.	—	—	C 2582
322	1·1 × 1·1	2′ 0″	B.	Wh.	—	—	HR 4318
323	0·95 × 0·95	2′ 0″	B.	Wh.	—	—	HR 4387
324	1·2 × 1·2	6′ 0″	B.	Wh.	—	—	HR 4098
325	1·1 × 1·1	2′ 0″	B.	Wh.	—	—	DK 2797
326	1·0 × 1·0	1′ 6″	B.	Wh.	—	—	DK 209
327	—	4′ 0″	B.	Wh.	—	—	C 2073
328	0·3 × ?	2′ 3″	B.	Wh.	—	—	DK 681
329	1·1 × ?	3′ 0″	B.	Wh.	—	—	HR 4348
330	1·45 × 0·8	4′ 5″	B.	Wh.	—	—	C 606
331	1·2 × 1·2	4′ 6″	B.	Wh.	—	—	VS 3093
332	—	—	—	—	—	—	BJ 1
333	1·35 × 1·3	6′ 6″	B.	Wh.	—	—	VS 3026
334	1·4 × ?	5′ 6″	B.	Wh.	—	—	E 1346
335	1·55 × 1·55	—	B.	Wh.	—	—	HR 2657
336	0·75 × 0·75	—	B.	Wh.	—	—	E 1846
337	1·5 × 1·55	8′ 6″	B.	Wh.	—	—	B 588
338	1·35 × 1·3	5′ 0″	B.	Wh.	—	—	HR 5028
339	1·4 × 1·4	3′ 0″	B.	Wh.	—	—	DK 2137
340	1·3 × 1·25	3′ 0″	B.	Wh.	—	—	HR 3080
341	0·8 × 0·2	Sur.	B.	Wh.	—	—	L 386
342	1·4 × 1·4	4′ 0″	B.	Wh.	—	—	HR 5992
343	1·35 × 1·4	1′ 6″	B.	Wh.	—	—	HR 4433
344	1·1 × 1·1	4′ 0″	B.	Wh.	—	—	C 2853
345	1·3 × 1·3	4′ 0″	B.	Wh.	—	—	HR 5635
346	1·1 × 1·1	8′ 0″	B.	Wh.	—	—	HR 5971
347	0·9 × 0·9	4′ 0″	B.	Wh.	—	—	E 1181
348	0·35 × ?	4′ 0″	B.	Wh.	—	—	VS 1438
349	1·0 × ?	2′ 6″	B.	Wh.	—	—	C 1893
350	0·7 × 0·7	2 6″	—	Wh.	—	—	DK 426
351	1·0 × 1·0	5′ 0″	B.	Wh.	—	—	C 427
352	1·0 × ?	2′ 6″	B.	Wh.	—	—	HR 4469
353	0·75 × 0·8	3′ 0″	B.	Wh.	—	—	D 392
354	?	3′ 0″	B.	Wh.	—	—	L 860
355	1·05 × 1·05	3′ 0″	B.	Wh.	—	—	DK 2869
356	0·9 × 0·9	3′ 0″	C.	Wh.	—	—	L 323
357	1·6 × 1·6	5′ 0″	B.	Wh.	—	—	VS 1574
358	1·2 × 1·2	0′ 6″	B.	Wh.	—	—	DK 797
359	0·65 × 0·35	6′ 6″	F.	Wh.	—	—	C 310
360	0·55 × 0·55	2′ 11″	B.	Wh.	—	—	D 417
361	1·2 × 1·2	4′ 6″	B.	Wh.	—	—	DK 2340
362	—	—	B.	Wh.	—	—	E 1651
363	—	3′ 0″	B.	Wh.	—	—	D 104
364	0·55 × ?	8′ 0″	B.	Wh.	—	—	VS 2876
365	1·1 × 1·1	2′ 6″	B.	Wh.	—	—	HR 1965
366	0·8 × 0·8	3′ 0″	B.	Wh.	—	—	HR 4055
367	0·75 × 0·75	3′ 6″	B.	Wh.	—	—	VS 3450
368	0·30 × ?	4′ 0″	B.	Wh.	—	—	C 675
369	1·25 × 1·25	4′ 6″	B.	Wh.	—	—	C 353
370	1·15 × 1·15	3′ 0″	B.	Wh.	—	—	HR 5611
371	0·45 × ?	10′ 0″	B.	Wh.	—	—	C 2053
372	1·3 × 1·3	2′ 6″	B.	Wh.	—	—	HR 1696
373	1·3 × 1·2	8′ 0″	B.	Wh.	—	—	HR 5972
374	1·5 × ?	2′ 5″	B.	Wh.	—	—	HR 4355
375	1·4 × ?	3′ 0″	B.	Wh.	—	—	VS 1816
376	1·15 × 1·15	6′ 0″	B.	Wh.	—	—	HR 4212E
377	1·05 × ?	5′ 0″	B.	Br.	—	—	E 1277
378	0·95 × 0·95	3′ 0″	B.	Wh.	—	—	HR 2596
379	—	4′ 3″	B.	Wh.	—	—	HR 5946
380	1·05 × 1·05	6′ 0″	B.	Wh.	—	—	HR 4952
381	1·3 × 1·3	4′ 6″	B.	Wh.	—	—	VS 1753
382	1·05 × 1·05	Sur.	B.	Wh.	—	—	L 384
383	1·4	3′ 0″	H.	Wh.	—	—	E 1886
384	1·2 × 1·0	1′ 2″	B.	Wh.	—	—	E 1432
385	1·0 × 0·2	2′ 1″	B.	Wh.	—	—	SD 2172
386	1·4 × 1·4	4′ 0″	B.	Wh.	—	—	C 2896
387	1·3 × 1·3	5′ 0″	B.	Wh.	—	—	B 63
388	0·8 × 0·2	8′ 6″	B.	Wh.	—	—	VS 3094
389	0·9 × 0·7	?	B.	Wh.	—	—	D 171
390	—	9′ 1″	B.	Wh.	—	—	DM 72
391	0·7 × 0·35	1′ 6″	F.	Wh.	—	—	C 51
392	0·3 × ?	2′ 0″	B.	Wh.	—	—	VS 2049
393	1·7 × 1·0	3′ 0″	F.	Bl.	—	—	HR 3130
394	1·5 × 0·6	6′ 6″	B.	Br.	—	—	C 3158
395	1·1 × 1·1	5′ 6″	B.	Wh.	—	—	VS 1190
396	—	4′ 0″	B.	Wh.	—	—	HR 5676
397	—	12′ 0″	B.	Wh.	—	—	VS 3227
398	—	9′ 0″	F.	Wh.	—	—	C 1814
399	—	—	—	—	—	—	BJ 9
400	1·0 × 0·95	3′ 0″	B.	Wh.	—	—	HR 3005
401	1·0 × 0·65	8′ 0″	F.	Wh.	—	—	HR 2023
402	1·55 × 0·5	8′ 0″	F.	R.	—	—	HR 6187
403	2·25 × 0·6	—	F.	Wh.	—	—	D 262
404	2·4 × 0·75	7′ 0″	B.	Wh.	—	—	VS 3546
405	1·85 × 0·6	2′ 6″	F.	Gr.	—	—	HR 1050
406	2·1 × 0·65	8′ 0″	F.	Wh.	—	—	DM 255
407	1·25 × 0·55	3′ 0″	F.	Bl.	—	—	DK 1436
408	? × 0·4	2′ 0″	F.	Wh.	—	—	E 2505
409	? × 0·4	3′ 0″	F.	Wh.	—	—	DK 1398
410	0·65 × 0·4	3′ 6″	F.	Wh.	—	—	VS 1681
411	0·6 × 0·45	4′ 6″	F.	Bl.	—	—	D 288
412	0·7 × 0·45	2′ 0″	D.	Br.	—	—	E 2039
413	0·7 × 0·45	2′ 0″	D.	Br.	—	—	E 2039
414	1·05 × 0·35	4′ 0″	F.	Wh.	—	—	SD 818
415	0·85 × 0·4	5′ 0″	F.	Gr.	—	—	D 114
416	0·8 × 0·35	1′ 6″	F.	Wh.	—	—	D 150
417	—	4′ 0″	B.	Wh.	—	—	HR 5167
418	1·1 × 0·45	3′ 0″	F.	Wh.	—	—	C 217
419	0·95 × 0·3	3′ 0″	F.	Wh.	—	—	HR 5796
420	0·05 × 0·45	8′ 0″	D.	Bl.	—	—	HR 5147

Plate No.	Size in Inches.	Level below Surface.	Type.	Materials and Colour. Steatite.	Faience.	Pottery.	Site and Serial No.
421	1·45 × 0·45	3′ 0″	F.	Wh.	—	—	VS 1082
422	0·95 × 0·45	6′ 0″	F.	Y.	—	—	HR 6210
423	—	1′ 9″	F.	Wh.	—	—	C 2056
424	1·2 × 0·4	5′ 3″	F.	Wh.	—	—	D 207
425	0·95 × 0·3	6′ 0″	F.	Wh.	—	—	HR 2780
426	1·55 × 0·45	2′ 6″	F.	Wh.	—	—	HR 1574
427	0·9 × 0·5	4′ 0″	F.	Bl.	—	—	DK 2732
428	0·65 × 0·4	3′ 6″	F.	Wh.	—	—	VS 1681
429	1·65 × 0·6	9′ 0″	F.	Wh.	—	—	E 2475
430	1·15 × 0·45	6′ 0″	F.	Wh.	—	—	HR 1121
431	1·65 × 0·7	1′ 0″	F.	—	—	R.	HR 116
432	? × 0·5	4′ 0″	F.	Wh.	—	—	HR 5260
433	1·2 × 0·75	4′ 0″	F.	Bl.	—	—	HR 4125
434	? × 0·4	2′ 6″	F.	Wh.	—	—	VS 1694
435	1·3 × 0·55	5′ 3″	D.	Br.	—	—	A 148
436	1·2 × 0·55	3′ 6″	F.	Wh.	—	—	HR 2674
437	0·9 × 0·5	3′ 2″	F.	Bl.	—	—	C 554
438	1·4 × 0·6	1′ 0″	F.	Wh.	—	—	E 1095
439	0·95 × 0·45	8′ 0″	F.	Wh.	—	—	DK 1638
440	1·3 × 0·55	5′ 3″	D.	Br.	—	—	A 148
441	1·05 × 0·5	5′ 0″	D.	Br.	—	—	HR 5248
442	1·05 × 0·4	3′ 0″	D.	Bl.	—	—	HR 3732
443	—	1′ 6″	B.	Wh.	—	—	HR 4434
444	1·05 × 0·45	2′ 3″	F.	Wh.	—	—	VS 3454
445	? × 0·55	5′ 0″	F.	Wh.	—	—	L 650
446	? × 0·5	3′ 0″	F.	Wh.	—	—	HR 350
447	1·5 × 0·45	6′ 4″	F.	Wh.	—	—	VS 2289
448	? × 0·85	10′ 0″	F.	Wh.	—	—	HR 6177
449	1·1 × 0·5	6′ 0″	F.	Wh.	—	—	DK 597
450	1·55 × 0·7	4′ 5″	F.	—	—	R.	C 656
451	1·25 × ?	2′ 6″	B.	Wh.	—	—	VS 880
452	— × 0·25	3′ 0″	F.	Wh.	—	—	B 290
453	1·2 × 0·65	3′ 0″	F.	Bl.	—	—	HR 3478
454	—	Sur.	F.	Wh.	—	—	L 291
455	? × 0·65	4′ 0″	F.	Wh.	—	—	HR 4373
456	0·6 × 0·25	5′ 6″	F.	Wh.	—	—	C 204
457	1·05 × 0·6	10′ 0″	F.	Wh.	—	—	VS 3553
458	1·55 × 0·2	8′ 4″	F.	Wh.	—	—	SD 1962
459	0·7 × ?	3′ 1″	D.	Wh.	—	—	VS 208
460	0·9 × 0·7	9′ 6″	I.	Wh.	—	—	VS 2846
461	? × 0·6	2′ 0″	F.	Wh.	—	—	HR 4459
462	? × 0·65	6′ 0″	F.	Bl.	—	—	HR 3767
463	? × ·65	3′ 6″	F.	Wh.	—	—	VS 953
464	1·45 × 0·6	2′ 5″	F.	Wh.	—	—	HR 4109
465	1·6 × 0·65	1′ 0″	F.	Wh.	—	—	VS 2100
466	1·5 × 0·65	1′ 0″	F.	Wh.	—	—	DK 1291
467	1·8 × 0·75	3′ 6″	F.	Gr.	—	—	C 1878
468	1·4 × 0·55	4′ 0″	F.	Wh.	—	—	HR 4285
469	1·1 × 0·6	10′ 0″	F.	Wh.	—	—	HR 3689
470	1·7 × 0·65	1′ 6″	F.	Wh.	—	—	HR 4237
471	0·7 × 0·7	9′ 0″	C.	Wh.	—	—	HR 2240
472	0·7 × 0·7	9′ 0″	C.	Wh.	—	—	HR 2240
473	0·7 × 0·7	9′ 0″	C.	Wh.	—	—	HR 2240
474	—	4′ 0″	—	Wh.	—	—	D 263
475	0·7 × 0·7	3′ 0″	C.	Bl.	—	—	E 904
476	0·7 × 0·7	3′ 0″	C.	Bl.	—	—	E 904
477	0·6 × 0·6	?	C.	Wh.	—	—	C 2631
478	Dm. 1·25	5′ 0″	H.	Wh.	—	—	VS 3027
479	?	5′ 0″	B.	Wh.	—	—	SD 533
480	? × 0·6	?	B.	Bl.	—	—	E 1007
481	?	?	?	—	Y.	—	?
482	0·55 × 0·35	9′ 4″	E.	Wh.	—	—	HR 1400
483	—	—	—	Y.	—	—	B 731
484	—	4′ 0″	?	Wh.	—	—	F 30
485	—	2′ 0″	B.	Wh.	—	—	C 40
486	—	1′ 6″	—	Wh.	—	—	C 1287
487	0·65 × 0·65	—	B.	Bl.	—	—	HR 4394
488	—	8′ 0″	—	Wh.	—	—	B 664
489	?	?	?	Wh.	—	—	?
490	—	5′ 0″	B.	Wh.	—	—	HR 2939

Plate No.	Size in Inches.	Level below Surface.	Type.	Materials and Colour. Steatite.	Faience.	Pottery.	Site and Serial No.
491	—	2′ 3″	B.	Wh.	—	—	E 894
492	—	6′ 0″	B.	Wh.	—	—	DK 595
493	1·25 × ?	2′ 6″	B.	Wh.	—	—	VS 880
494	1·3 × 0·7	2′ 0″	F.	Wh.	—	—	DK 931
495	1·05 × ?	2′ 0″	B.	Br.	—	—	DK 844
496	? × ? × 0·3	?	B.	Bl.	—	—	DK
497	—	4′ 0″	B.(?)	Wh.	—	—	VS 3331
498	? × 0·45	7′ 0″	F.	Bl.	—	—	E 2528
499	—	5′ 0″	B.	Wh.	—	—	DK 2363
500	0·75 × 0·75	2′ 9″	E.	—	Y.	—	D 234
501	0·5 × 0·5	2′ 0″	E.	—	Wh.	—	HR 2728
502	0·6 × 0·6	3′ 4″	E.	Wh.	—	—	HR 5572
503	0·7 × 0·7	Sur.	E.	—	Wh.	—	L 209
504	0·75 × 0·75	3′ 0″	E.	—	Y.	—	HR 5593
505	0·65 × 0·65	5′ 0″	E.	—	Wh.	—	DM 7
506	0·7 × 0·7	8′ 0″	E.	—	Wh.	—	HR 6147
507	0·65 × 0·65	3′ 0″	E.	—	Y.	—	HR 4869
508	0·8 × 0·8	—	C.	Wh.	—	—	HR 4503
509	0·65 × 0·65	6′ 0″	E.	—	Wh.	—	HR 6163
510	0·55 × 0·55	4′ 0″	E.	—	Y.	—	HR 5628
511	0·7 × 0·7	3′ 0″	E.	—	Y.	—	HR 5657
512	0·7 × 0·7	—	E.	—	Y.	—	E 1723
513	0·7 × 0·7	5′ 0″	E.	—	Y.	—	VS 1960
514	0·7 × 0·7	12′ 0″	E.	—	Y.	—	HR 1964
515	0·65 × 0·65	1′ 6″	E.	—	Y.	—	E 1989
516	0·65 × 0·65	Sur.	E.	—	Gr.	—	HR 1
517	0·55 × ?	3′ 0″	—	—	Y.	—	C 2927
518	0·6 × ?	—	E.	—	Wh.	—	MUS 8
519	? × ? × 0·3	2′ 9″	B.	Wh.	—	—	D 349
520	0·55 × 0·55	6′ 0″	E.	Br.	—	—	HR 6207
521	0·55 × 0·55	5′ 0″	E.	—	Y.	—	VS 1278
522	? × 0·6	Sur.	F.	Bl.	—	—	DK 1298
523	? × 0·6	5′ 0″	G.	—	Y.	—	VS 928
524	—	3′ 0″	G.	—	Y.	—	B 594
525	—	—	G.	—	Y.	—	E 1261
526	0·7 × 0·7	3′ 6″	G.	—	Y.	—	E 492
526b	1·1 × 0·40	3′ 6″	F.	Wh.	—	—	L 702
527	Dm. 0·75	5′ 0″	J.	Wh.	—	—	E 1908
528	0·7 × 0·7	2′ 0″	G.	—	Y.	—	HR 3388
528b	0·7 × 0·75	4′ 0″	E.	—	Y.	—	VS 3459
529	2·7 × 0·25	4′ 0″	A.	Ivory	—	—	HR 5515
530	? × 0·25	3′ 0″	A.	Ivory	—	—	HR 4985
531	? × 0·3	4′ 0″	A.	Ivory	—	—	DK 2666
532	? × 0·3	12′ 0″	A.	Ivory	—	—	VS 875
533	2·75 × 0·3	10′ 0″	A.	Ivory	—	—	VS 958
534	1·35 × 1·35	8′ 0″	B.	Wh.	—	—	DK 1543
535	1·2 × 1·2	2′ 6″	B.	Wh.	—	—	VS 665
536	1·1 × 1·1	6′ 0″	B.	Wh.	—	—	HR 5787
537	1·15 × 1·15	3′ 0″	B.	Wh.	—	—	VS 955
538	0·30 × ?	4′ 0″	B.	Wh.	—	—	C 2072
539	1·2 × 1·2	2′ 0″	B.	Wh.	—	—	DK 121
540	1·25 × 1·3	5′ 0″	B.	Wh.	—	—	D 208
541	1·2 × 1·2	2′ 0″	B.	Wh.	—	—	HR 99
542	1·2 × 1·2	6′ 0″	B.	Wh.	—	—	L 785
543	1·15 × 1·15	1′ 0″	B.	Wh.	—	—	HR 4435
544	1·3 × 1·3	4′ 0″	B.	Wh.	—	—	DK 3018
545	—	—	B.	Wh.	—	—	HR 2022
546	0·9 × ?	1′ 6″	B.	Wh.	—	—	F 47
547	0·9 × ?	—	B.	Wh.	—	—	HR 5876
548	1·4 × 1·4	8′ 6″	B.	Wh.	—	—	HR 1110
549	1·4 × 1·4	—	B.	Wh.	—	—	MUS 1
550	1·2 × 1·2	2′ 0″	B.	Wh.	—	—	HR 140
551	0·9 × 0·25	3′ 0″	B.	Wh.	—	—	HR 4399
552	1·25 × 1·25	8′ 0″	B.	Wh.	—	—	B 428
553	1·55 × 1·55	4′ 3″	B.	Wh.	—	—	SD 92
554	—	2′ 0″	B.	Bl.	—	—	DK 2651
555	1·4 × 1·4	17′ 6″	B.	Wh.	—	—	DM 135
556	0·85 × 0·85	5′ 6″	B.	Wh.	—	—	C 2077
557	1·2 × 1·2	6′ 0″	B.	Wh.	—	—	VS 623
557b	1·15 × 1·15	8′ 0″	B.	Wh.	—	—	B 426

CHAPTER XXII

SIGN-LIST OF EARLY INDUS SCRIPT

1. SOME EXTERNAL FEATURES OF THE WRITING

[From p. 406 to p. 411 this chapter expresses the joint views of Messrs. Smith and Gadd. From the bottom of p. 411 to p. 414 it expresses the views of Mr. Gadd only, and from p. 415 to p. *422 those of Mr. Smith.]*

Script not deciphered.

THE accompanying list of signs used in the inscriptions upon seals found at Harappā and Mohenjo-daro is offered for the use of those who may in the future devote themselves to the study of this writing. It is published as a contribution, indeed, to that study, but rather as a tool ready to the hand of scholars when time may have brought the possibility of further achievement, than as a finished production in itself. For the aim of such study must naturally be the decipherment of this script, and it is proper, therefore, to state at the outset that we have not succeeded in reading anything of it ; there was, in fact, very little hope, in the complete absence of any kind of clues which might lead to some trustworthy inference. Hope for the future most probably rests in Mesopotamia. It is known for certain that seals and sealings of this class were carried thither by trade from the Indus valley in ancient times,[1] and one such seal has already been found (at Ur) with a *cuneiform* in place of an " Indus " inscription.[2] There is consequently reason to hope that some day a bilingual record may be discovered, and very few data of this kind would probably suffice to reveal the secret. Meanwhile, all that can be done is to prepare the material to which the solvent may ultimately be applied.

Indus seals found in Mesopotamia.

Difficulty in classifying signs.

Even for the modest purpose indicated we are sensible that the list we have compiled is far from perfect. Its faults arise partly from the inherent difficulty of classifying signs simply by their outward appearance, but partly, too, from the nature of the copies which we have used. These have been photographs, showing sometimes the original seals, sometimes the impressions, and hence the order of the signs may now and then have been unintentionally reversed ; if this has occurred, however, the attentive student, once familiar with the writing, will probably detect and allow for it. A more serious defect will doubtless be found in the making of distinctions between signs which are differently drawn in certain instances but are actually identical, or, conversely, in the neglecting of actual distinctions between signs which are very similar in appearance. As an example of the first, CCXLII and CCXLIV may be quoted (these two are probably not different), and of the second, the number of " barbs " on signs of the class CCLXIV may sometimes have been incorrectly given, and here a real distinction may have been observed—though it is perhaps not very likely. Faults of this

[1] They have been recovered from at least four sites, the ancient cities of Kish, Lagash, Umma, and Susa ; see the article by Mr. E. Mackay in *Journal of the Royal Asiatic Society*, 1925, pp. 697 f. and pl. x, and also that of M. Thureau-Dangin in *Revue d'Assyriologie*, xxii, 99 for another specimen and further references.

[2] Mr. C. L. Woolley in *Antiquaries' Journal*, 1928, p. 26 and pl. xi, 2.

kind arise, of course, from the first-mentioned difficulty, that of dealing with a script purely from outward appearance, without knowledge wherewith to control eye and hand.

Device and legend unconnected.

The form and material of the seals, their archæological character and context, will be found fully described in the preceding chapter; preliminary accounts of them have already been given in periodicals. All that need be said here is that there seems to be no direct connection between the device engraved upon the seal (usually an animal) and the inscription, the same animal being found in company with completely different inscriptions. The devices may be presumed to have religious significance, and perhaps some amuletic value.

Signs are pictographs.

As concerning the signs themselves, the number listed here is 396, which must be considered only a very approximate measure of the signary of this writing, both because the material is still, no doubt, far from complete, and because of the slight uncertainty of distinction mentioned above, but also because of the great resources of modification and combination of signs which this writing possessed, the extent and ingenuity of which is perhaps its most striking feature. The signs are pictographs, as in all other early scripts. They are carefully drawn as faithful representations of their originals in all cases where the original can be identified, and the same may therefore be presumed of the much more numerous cases where the original is doubtful. That is to say, the writing remains in what may be called, on Egyptian analogy, the hieroglyphic state; it has not degenerated nor been worn down by use, to conventional summaries like the Egyptian hieratic, the Babylonian cuneiform, or the Chinese writing. This is certainly due in great part to the material upon which these inscriptions are found, since pictographs always preserve their form best when they have to be sculptured on stone, but tend to lose it when they are employed cursively on soft substances like clay, papyrus, or parchment. Whether the Indus people wrote upon more perishable materials, and what form the signs then assumed, there is nothing to show, but the scratched characters found upon potsherds and copper utensils suggest a more extended usage.

Objects imperfectly represented.

Clearly as the signs are drawn it is a remarkable fact that few can be identified. This difficulty is familiar in other early scripts also, but it is generally due rather to imperfect representation than to actual uncertainty of the object intended; this applies particularly to the archaic Sumerian signs, which, while often suggesting the original, very seldom portray it unmistakably, and often seem very doubtful representations of the objects which their known meanings presumably indicate. Among the Egyptian hieroglyphs only a few still resist identification. No doubt further study of this "Indus" writing will reveal more of the objects represented, but at present the list is surprisingly short. The following are some additions or alternations to the very tentative proposals made by us in the *Illustrated London News* of 4th October, 1924, p. 614.

Numbers.	*Possible Identification.*
I to XVIII	Strokes, representing numbers.
CCCLXIX to CCCXCVI	Men in various attitudes.
CCCLXX	Man standing.
CCCLXIX	Man raising arms.
CCCLXXVII	Man with staff.
CCCLXXVIII	Man with bow and arrow (or, more probably, defending himself with a shield), in any case, a warrior.
CCCXCVI	Man with staff raised.
CCCLXXIX f.	Man holding up three or five fingers.
CCCLXXXV	Man holding yoke (possibly abbreviation of the following picture).

Numbers.	*Possible Identification.*
CCCLXXXVI	Man carrying on a yoke two water-skins (ligature of above and No. CLIX).
CCCLXXXVII	Man carrying on a yoke two water-skins (ligature of above and No. CCXXXVIII).
CCCXXXI to CCCL	Fish, with various additions and insertions.
CCLV ff.	Hand, with different numbers of fingers outstretched.
CCLXI	Hands (?), indicating the number 13 (?)
CCCLI ff.	Birds and animals; among which CCCLXIV seems to be a drake, and CCCLIX a bat.
CCLI f., CCCLXVI f., and perhaps CCXXXVIII	Plants.
CXXXV ff.	Mountains (?)
LXV	Heart (?)
CLIX	Spear.
CCCXIX	Chair.
CCCXXII	Table.
CCCXXIX	Parasol (cf. CCCLXXIII).
CCLXXXIII	Road.
CCXLVII ff.	Foot.
LII ff.	Insects.

Parts of human body.

Apart from the apparent numbers, which will be considered later, there are a few remarks to be made on the foregoing list. It is rather noticeable that, whereas men in various attitudes are well represented, there are few parts of the body among the signs; seemingly the only exceptions are the hand and foot, if, indeed, Nos. CCLV, CCXLVII are correctly so interpreted. Among the "man" signs No. CCCXCVI gains certainty from the object published in *Times of India*, 22nd January, 1928,[1] which shows on a larger scale a man standing in exactly the position which the sign depicts in miniature. That Nos. CCCLXXIX f. really indicate a number of fingers held up is suggested by the circumstance that they follow, in the inscriptions, three and five strokes respectively. The pictures of the man carrying the yoke, and the two water-skins or sacks hanging from it look quite unmistakable, and equally clear seems the nature of the composite signs CCCLXXXVI f., particularly as these occur in positions where CLIX and CCXXXVIII are expected.

"Fish" signs doubtful.

The suggested "fish" signs are more puzzling, since the modifications to which the original (?) CCCXXXI is subjected are not particularly natural as indicating different kinds of fish, and it is by no means certain that a fish is intended at all, but the comparison suggests itself at once, and it is hard to find a better. That CCLV and the like represent the hand with different numbers of fingers extended must be considered a very doubtful possibility, since there are instances in which more than five digits are shown, although, on the contrary, there is the very suggestive case of the man (No. CCCLXXX) who seems to hold up five fingers while he stands next to five strokes, and these "fingers" with his forearm, have much the appearance of the "hand" signs.

Indus signs compared with Sumerian.

In the *Illustrated London News* (loc. cit.) we formerly proposed a comparison between these "hands" and the archaic Sumerian form of *gal*; outwardly, this is still striking, but if the "Indus" sign really represents a hand this comparison would have to be abandoned, since, although the original of the Sumerian sign is uncertain, there is no reason to connect it with the hand. The elaborate character No. CCLXI is perhaps to be explained as the fingers of one hand twice outspread, and three of the other hand held up, the whole indicating the idea of "thirteen". Instructive comparisons with this sign are Nos. CCLX and CCXXXII, but

[1] Cf. Pl. CXXXII, 10.

Birds and animals identified. Representations of plants doubtful.

whether favourable to the "hand" supposition or not it is not easy to decide. The birds and animals are more obvious, but it is impossible to be more precise as to their kinds save in the cases of the drake and the bat. Nearly all of the plants must be pronounced doubtful, though No. CCLII seems a clear instance; it would be something if No. CCXXXVIII, by far the commonest sign of all, could be identified as a plant, but actually it is very questionable. "Mountains" are simply an analogy from the Sumerian sign *kur*; the analogy is perhaps quite illusory. The same remark applies to No. CCLXXXIII "(cross) road", and to No. LXV "heart", especially to the latter, which has further modifications tending to show that the "heart" form is merely an oval with one segment (instead of four) cut out from it. Finally, the "table", "spear", and "parasol" have to rely only upon their outward form, though the last is seen over the head of a man in No. CCCLXXIII. Doubtless several more suggestions will occur to any user of this list; we have confined ourselves to such as seemed most obvious to a purely outward view.

Other objects.

Modifications of signs.

The extensive use which this writing makes of modification and combination of signs has already been mentioned and it is, indeed, one of its most striking peculiarities. While it is difficult to give any conspectus of the modifications, a rough principle at least may be observed by dividing them into "*additions*" and "*enclosures*". By the first we mean the small strokes, generally vertical, and standing beside the top of the sign modified, but some times also oblique, in which case they are contained within the sign (as indeed are the vertical strokes in a few cases). "*Enclosures*" are signs which stand in the midst of a varying number, usually of vertical strokes, but occasionally within a kind of parenthesis. Groups of this latter kind are, naturally, of rather similar composition to the *combined* signs, and the distinction between the two is based principally on the use of simple strokes (nearly always) in the "enclosures", whereas the combined signs are coalitions of two entirely different individuals. The "additions" are:—

...., "...., ..'''.., ../.., ../.., ..^..

"Enclosures" are constituted by the following:—

|....|, ||....||, ¦....¦, ⁞....⁞, (....),)....).

The principal combinations are given in the following table:—

Combined Sign.	*Elements.*
CXLIX.	LXXIII and CCXXXII.
CL.	LXXIII and CLII.
XLVIII in a number of combinations.	—
LXXVIII f.	XLVIII and CCLXXXIII.
CXXIV f.	CXII and CCXXXII.
CCCLXXIX f.	CCCLXX and CCLV f.
CCCLXXXVI f.	CCCLXXXVI with CLIX and CCXXXVIII.
CCCLXX in a number of combinations.	—
CCLXI.	CCXXXII and CCLX.

Direction of Writing.

Next to the signs themselves the direction in which the writing runs is to be considered. First, however, it must be repeated, as M. Thureau-Dangin has already observed,[1] that the *impression* produced by the seal, not the seal itself, gives the true order of the inscription. This may be shown best by turning from the seals (upon which, of course, most of the inscriptions occur) to the other objects, pottery or metal, upon which signs have been scratched; for there the legend is naturally to be read as it is written. A pottery fragment from Harappā,

[1] *Revue d'Assyriologie*, xxii, p. 100.

No. 2779, is inscribed with two completely preserved signs, the one on the spectator's left being No. XCIX of our list ; in the pot-inscription, the opening of this sign faces to the right. As an example of the same sign upon a seal we may quote the inscription given as No. LXXIV, H. 40, in the list. Here it is found in the second place from the right, and with the opening again facing to the right. But the inscription as there copied is from an *impression* of the seal ; a photograph now before us of the seal itself naturally shows this sign with its opening towards the left. But since the pot-inscription gives the signs in the position in which they were meant to be read, it follows that the sign in question is properly placed with its opening facing to the right ; that is, the impression, not the seal, presents the inscription in its true form. An exactly similar experiment can be made with the copper dagger-blade from Harappā, No. $277\frac{Pa}{7}$. Here also the inscription is obviously meant to be read directly, and the sign furthest to the spectator's right is No. XXXI, with its " loop " on the left. Now this sign is found also upon the seals, of which No. XXXI (H 31) may be taken as an example. A photograph of this seal (not its impression) shows, as before, the sign reversed, i.e. with its "loop" on the right; hence again the impression gives the correct form, not the seal. There is no need to multiply examples, since these two suffice for proof, and indeed the proposition that seals are made for the purpose of reproducing a device, not to be looked at themselves, flows so directly from the nature of seals, and is so supported by all analogies that it might seem almost self-evident. However, it can be formally established in the present case, as shown above. Perhaps also it may be well to mention that at least one ancient impression of an Indus seal has already been published,[1] showing that these marks were affixed to clay labels upon bales of goods, in precisely the same way as the Babylonian seals were rolled over the clay " dockets ", or the Egyptian seals impressed upon the clay stoppers of wine-jars.

Position of Signs.

Clay labels on bales.

The correct way of looking at the inscriptions having been settled it remains to take up the original question—in which direction does the writing run ? An answer which we believe to be right, though based on quite insufficient evidence, has already been given by M. Thureau-Dangin[2] : " les inscriptions sont à lire de droite à gauche, comme le montre l'un des signes du no. XV, représentant un oiseau de profil à droite." The number referred to is No. CCCLXIV of our list, and it is true that in the impression of this seal the bird enclosed in a ring (it seems to be somewhat carefully marked as a drake) faces to the right. It is, of course, a well-known rule of the Egyptian hieroglyphs that the inscription is read from the side to which the figures face. But it is easy to show that this is no safe indication for the " Indus " writing ; for while most of the " men " signs face to the right (cf. Nos. CCCLXXIV to CCCLXXX in the list), there are several birds and animals (cf. Nos. CCCLIV to CCCLVIII) which face to the left ! Some other criterion must therefore be sought, but is not altogether easy to find. First it will be noticed that in nearly all cases the bull or other animal which forms the main subject of the seal faces to the right, and there is consequently a presumption that the inscription begins from its head. There is, nevertheless, at least one exception to this stance of the animal, for in the impression of the Seal No. 341 a rhinoceros faces to the left. This may be an inadvertence, but it s u ces to warn us against relying too much on the usual position of the animal as indicating the beginning of the inscription. Another small indication may be found in the usual manner of writing the sign composed of seven strokes ('|||) in which the lower three are nearly always placed level with the right end of the upper four. A very significant example, too, is a seal

Signs face to the right and left.

[1] By Father Scheil in *Revue d'Assyriologie*, xxii, p. 56.
[2] *Ibid.*, p. 100.

from Harappā (No. 5629) which makes it evident that the engraver has been cramped for space, and that in consequence not only were his signs closely bunched together, but the space remaining on the left side was not sufficient to take another sign, which has therefore been dropped below the line. The inference that the inscription began from the right is almost irresistible. But there is a final instance which puts this conclusion beyond doubt. The seal H 173 found in the excavations of 1926–7, is peculiar in having no animal device, but a long inscription which occupies two whole sides of the square and most of the third side. Now (in the impression, of course), this inscription occupies all the top side, all the left side, and most of the bottom, thus [⊏], the signs being turned 90 degrees at each corner in such a way that their tops always follow the edges. It is manifest, therefore, that the inscription was read turning the sealing round in the hand, and the position of the second and third sections shows that it was turned over towards the right; in other words, that the reader began from the right of the first and longest section, turned the sealing through 90 degrees, read the second section again from right to left, and similarly the third. Proof that these inscriptions are to be read from right to left seems herewith complete.[1]

Reading from right to left.

Up to this point it has been possible to write with some assurance upon certain outward characteristics of the "Indus" script, but whatever is now added must concern its actual mechanism and reading, and must therefore, in the absence of any advance towards decipherment, be largely speculative. Perhaps, indeed, it would be prudent to stop entirely here, but there are a few observations that may still be advanced, and cannot, at least, do any harm provided the reader be amply cautioned that they are no more than tentative suggestions, which time may well prove completely erroneous.

First, then, something ought to be said about the possible affinities of this script. Being at that time in possession of very little evidence we once ventured to comment on a few resemblances between certain "Indus" signs and certain archaic signs of the Sumerian syllabary. This hint was on the one hand taken up with exorbitant enthusiasm and regrettable results, on the other rejected with an emphasis which mistook a suggestion for an affirmation. We need not dwell upon this longer than to remind the over-rigid that conjecture has its most legitimate place where other resources are lacking, and has played a brilliant part in former decipherments of unknown scripts; nor is it likely to be otherwise here. But, for the question in hand, we shall admit without hesitation that further experience has not tended to confirm our faith in any direct connection between the writing of Sumer and the Indus. The list which we gave could not now be much extended, some of the comparisons are doubtless fortuitous or occasionally far-fetched, and it is not improbable that a similar list could be constructed with the aid of other early scripts, such as the Minoan, which indeed affords some striking analogies. When it is reflected how many totally different scripts are known to have been employed within areas smaller than that which divides the Tigris from the Indus, no surprise will be felt that connection in this case cannot be established. Contact between the two peoples certainly existed; we think even that they shared certain cultural influences, but the presence of common elements in their mode of writing cannot be proved.

Few resemblances between Indu and Sumerian signs.

Analogies of Indus and Minoan script.

What is likely to be the nature of this script? That it is not an *alphabet* must be obvious from the number of its signs; such a notion cannot seriously be taken into account. On the other extreme, it can hardly be a pure picture-writing in which every sign represents a word, since a very short search will reveal groups of signs which frequently appear in the inscriptions in different contexts and often with the insertion of one or more varying signs. While no great certainty can be felt about this matter, it remains true that the general impression derived

Script not an alphabet.

[1] On this subject, see pp. 40 (with footnote) and 427–8.

Signs probably syllabic.

from the study of these inscriptions is that the signs are probably syllabic, with the admixture of some "ideograms", and perhaps determinatives; in short, that the system is perhaps not very much different from that of the cuneiform writing. It would be possible to produce some slight support for this conclusion, but nothing which would amount to substantial evidence, or deserve the trouble of critical examination. The use of determinatives, moreover, is far from certain. Perhaps the most likely examples are those in which a man holds up five or three fingers, standing next to those numbers of strokes respectively, and certain other of the "man" signs may also be of this class.

Inscriptions probably Names and Titles.

The contents of the inscriptions must evidently be a matter of simple conjecture, so long as they are not read, but, in view of their being mostly found upon seals, it must occur immediately to anyone that they include *names*, very probably of the owners. Many, perhaps, especially of the shorter inscriptions, may be regarded as names alone, but others seem to add qualifications, which may be titles. This is particularly suggested by some of the two-line inscriptions, of which Seal 12 will serve as an example. Here the upper line seems to consist of two words, each ended by the common ending sign CCXXXVIII, while the lower line has only three signs, of a very "ideographic" appearance, headed by one which might well be a determinative. Such a group has a very decided appearance of an appendage to the upper line, and of expressing a qualification or title. Other examples may be found in LXXXIX, 99; VII, 209; CCCXXXI, 321; CCCXXIX; and elsewhere. There is, however, a different hypothesis as to the contents of these inscriptions, which is strongly suggested by several examples, namely, that they are, or at least contain, references to quantities or numbers of objects. Since it is known that these seals were sometimes affixed to bales of cloth and packages of goods, in precisely the same way as the Babylonian seals, such an inscription might be very appropriate; the Babylonian practice was, of course, to inscribe a note of the contents upon the clay "docket" with the ordinary stilus, and to confirm the whole by impression of the seal. Particular instances can be found very favourable to this supposition; they are those in which the number-signs (collections of plain strokes) accompany only one or two other signs, and the whole consequently appears to signify "*x* objects" (see especially No. CCXIX, which very commonly stands alone with, 2, 3, or 4 strokes, but similar arrangements are found, as may be seen under Nos. I to XVIII). In spite, however, of these very remarkable appearances, there are reasons, both general and particular, which tell strongly against the idea that the inscriptions are concerned mainly with notes of quantity. In general, then, there is a prima facie unlikelihood that a seal should be cut in a permanent material to mark a quantity, since in commerce such quantities must have been multifarious, and thus a separate seal would have been required for each, a most cumbrous contrivance. Further, it is possible to quote the unique seal recently found at Ur (see p. 406 above), the cuneiform inscription upon which, though indistinct, certainly has nothing to do with numbers or quantities. But of more weight than these generalities is the evidence of the inscriptions themselves, i.e. the manner in which the apparent number-signs are involved. First, it should be observed that to extract a numeration-system from these writings seems impossible. Counting strokes, the only numbers found are 1, 2, 3, 4, 5, 6, 7, 8, and 12,[1] and even these occur in different sizes and arrangements of unknown significance. Nine, ten, and eleven cannot be identified though there is a possibility that they are denoted by a different kind of signs; thirteen is, it may doubtfully be suggested, represented by No. CCLXI. With so restricted a range of numerals, even admitting the

Numerical system doubtful.

[1] The "treize bâtonnets" mentioned in *Revue d'Assyriologie*, xxii, p. 101, are composed of the usual 12 and the modifying mark 1 attached to the preceding sign.

possibility of others not identified, it is hard to believe that a complete numerical-system exists in these inscriptions. Again, very little inspection of the text will reveal examples in which the apparent number occurs near to the beginning, or in the middle of a longish inscription, followed by several signs which have no obvious numerical value. Even if it be assumed that preceding signs are in some way higher "powers" of numbers, there is no such explanation for what follows, and the mere presence of a seemingly numerical sign in a long inscription is insufficient ground for assuming that the inscription conveys a note of quantities. Furthermore, not a few examples are found in which two numerical signs stand side by side, as ||| |||, or ⁝⁝⁝ |||, or ⁞⁞⁞ |||, and it is very hard to understand why so peculiar a form is adopted, if they are really numbers. Finally, to conclude the examination of this question, it will be interesting to take two or three individual cases. The first two inscriptions in the list are not uninstructive; the second might be interpreted "two men, one water-bearer", but the first has only the second part of the inscription, with a qualifying sign added. Even so it would still be possible to interpret this as "|——— water-bearer", but it is then to be noted that the added sign CCXXXVIII can itself follow "numbers", so that it can hardly have been a mere qualification. Even more difficult is No. H 149, where if both | and || are numbers, the whole must be a plain number, and that incomprehensibly expressed. Also, what should be the difference between [sign] and [sign] or [sign] and [sign], all of which are found? Lastly, if the sign XV be consulted, it will be found that this "number" occurs almost exclusively before one or two special signs; there should be no reason for this if the group really denotes the number seven. The general conclusion is that these collections of strokes, though obviously containing a certain number of units, are not here used in a numerical sense, but most probably with a phonetic value, which is perhaps derived from the native words expressing the respective numbers.

Strokes probably not numerical.

The peculiar and at present (it seems) hopeless difficulty in the way of decipherment is the complete lack of exterior evidence. The finds in the Indus valley have been the first revealers of an Indian civilization of high antiquity, which appears to have left no traditions of itself. What may have been the race and language of this people is a question of pure conjecture. We must end where we began, with the hope that Mesopotamia, which has already revealed so infinitely much of ancient history, here also will not fail. The appearance at Ur of an "Indus" seal with a cuneiform inscription is full of hope; its three signs are all, unluckily, indistinct, but the reading is perhaps *Sak-ku-shi* or *ka-lu-shi*,[1] probably a name indeed, but whether characteristic of the Indus population we do not know. One other interesting reminiscence of these seals may be mentioned; there are certain devices and punch-marks on coins from N.W. India which have a strong apparent likeness to these ancient pictures. We may refer to the new British Museum "Catalogue of the Coins of Ancient India", where the feeding rhinoceros on No. 70 (p. 16), the bull with the "symbol of Taurus" before him, No. 16 (p. 18), and some of the devices described on pp. 120 ff. seem not very far removed, if not direct descendants, from the pictures engraved on the seals of Harappā and Mohenjo-daro.

Indus seal found at Ur.

Devices on coins from N.W. India similar to ancient Indus pictures.

The following note may be completely neglected by those who object to licence in speculation, as it may also be decisively exploded even by those willing to try heroic measures.

First, then, a series of assumptions will be made, for which there is no proof, and next

[1] *Ka-Ku-wa*, equally possible, might be compared to such names *Kakia*, already, known as used east of Tigris and in Asia Minor.

A Conjectural Reading.

to no evidence; the third will be rejected at the outset by the best-informed opinion. Nevertheless let them be made :—

(*a*) That the writing is, at least in part, syllabic.
(*b*) That the seal-inscriptions are, in general, names.
(*c*) That these names belong to an ancient Indo-Āryan language.[1]

These are the general assumptions; what likelihood the first two may have is considered above. The third, as already observed, would be denied by most Indologists on the ground that Āryans were not present in India at the period (before 2600 B.C.) to which these seals presumably belong—the date itself is, of course, not satisfactorily ascertained. Since, however, we are admittedly guessing, we shall not even pause to make any attempt (which must be unsuccessful) to meet these objections.

Next, can anything be found to which a conjectural *meaning* may be attached? Once more, as in settling the direction of the writing, let us appeal to Harappā H 173. Here the first (top) line may be supposed to represent a name, ending with the very common CCXXXVIII, which indeed, wherever it occurs, seems nearly always to end a word. The second (side) line is the fairly common group ⇧|||U; the third (bottom) line may be another name; it is not dissimilar in fact, to I, 218, which elsewhere stands alone. The next conjecture, then, will be that this whole inscription signifies "M son of N", and consequently that ⇧|||U = "son". If now we boldly act upon the general assumption (*c*) *supra*, we shall substitute for "son" the Sanskrit word *putra*.[2] Of the three signs in this group we can treat the first and last as doubtful, but the middle consists of three strokes, and presumably represents simply the number three. If we take again the Sanskrit word for that number, *tri*, an interesting result is obtained :—

⇧|||U	*x* — *tr*(*i*) — *y*
son	*pu* — *tr* — *a*

From which these values would be ascertained :—

U = *p*(*u*), ||| = *tr*(*i*), ⇧ = *a*

Could these be established it would follow that the principle of akrophony had some application in this writing, and further that the not uncommon examples of inscriptions ending with the above group would be patronymics. Unhappily there seems to be nothing whatever by which the above pleasing speculation can be tested. The reader who has persevered so far may take it that I am fully conscious of many objections which it would not even be worth while to formulate here, since they could not possibly be answered out of a simple conjecture.

[1] On the subject of the Vedic Āryans see pp. 109–11.

[2] For the present purpose it makes no difference that in Sanskrit the form used is "N's son M", not "M son of N".

II. The Mechanical Nature of the Early Indus Writing

Script used in third millennium B.C.

The writing found on seals and other objects from Mohenjo-daro and Harappā was intended to be read from right to left; it cannot be purely alphabetic in character; and it is probable from the seals found at Susa and Kish, and from the analogy of a seal found at Ur, that it was in use in the first half of the third millennium B.C.

No help is to be derived, so far as an understanding of the inscriptions is concerned, from the intaglios on the seals; just as the same device may occur with different inscriptions, so the same inscription can occur with different devices.

It is believed that the inscriptions on the small, stone rectangles from Harappā belong to an earlier period than the inscriptions on the large seals. Early inscriptions frequently present more complications than later ones, so far as questions of phonetic reading and interpretation are concerned; the "mechanical" nature of early writing is generally more simple.

Mechanical nature of writing.

By the "mechanical" nature of writing is meant the manner in which the signs are used. Of those writings which are not purely alphabetic it may be said that signs fall into one of three classes, syllables, ideograms, determinatives. In any one inscription a sign can only belong to one of these classes, but it may in different inscriptions belong to all three. If a sign is used with a syllabic value, it may in different inscriptions have different syllabic values. If a sign belongs to the last class, it may determine meaning, in which case it has no bearing upon the sound of the word, or sound, in which case it generally marks the first or last sound in a syllable, or the first or last syllable in a polysyllable. A determinative of sound is usually called a complement, and is particularly useful when ideograms permit of variant readings.

Material nature of writing.

In this sense the "mechanical" nature of the writing does not include the "material" nature. The complications of the "material" nature of the signs arise from two main features of the script, modifications, whether internal or external, and combinations. The modifications, when simple, consist of a stroke or strokes in various positions, sometimes placed inside, sometimes adjoined, sometimes separate. In rare cases the constant addition of modifications transforms the appearance of a sign, see Nos. CCCIV to CCCIX. Combinations may be effected by interior adjustments or by simple ligature. It seems probable that at any rate in certain cases the ligature has the same sense as the two signs in juxtaposition, see Nos. CVIII and CII. In Sumerian and Egyptian, parallels could be cited for such modifications and combinations; the Indus writing differs from them in its frequent use of these compound signs, and by its use of the two together, to judge from the series Nos. CXL–CXLIV. The "material" nature of these signs suggests an extremely ingenious invention, dependent upon the use of certain fixed principles; but it does not throw any light on the "mechanical,' use of the signs. Whether combined or modified signs retain their separate significance or acquire new phonetic values and meanings depends upon an examination of the "mechanical" use of the script.

Division of signs.

The object of such an examination must be to divide the signs into classes, of the three kinds mentioned. Such a division of these signs presents insuperable difficulties. This examination must commence by a recognition of three fairly obvious classes of signs, (*a*) the "end" signs, (*b*) the "beginning" signs, (*c*) the "numeral" signs. Of the "end" signs, the commonest has not been separately entered in the present list, for obvious reasons. The sign occurs nearly always at the end of inscriptions. When it occurs in the middle it can generally be proved that it there marks the end of a word or group. A favourable instance

of this kind may be found under sign No. CCLXXXIII. The form of the inscription (No. 12) in which the two first signs are repeated after the first occurrence of the "end" sign, and the first line of the inscription closes with the "end" sign, is sufficient to illustrate this point. But there are some peculiar cases. Sign No. CLIX appears so constantly at the end of inscriptions, or at the end of groups in inscriptions, that it clearly belongs to the class of "end" signs; yet it can appear at the beginning of such inscriptions as H 208 and 329, which consist entirely, it should be noted, of signs which belong to the "end" class. These instances are sufficient to prove that this sign No. CLIX is not a peculiar form of a phonetic sign used only at the end of words. There must be some peculiarity in the sign which demands that it should ordinarily stand at the end, and which allows only of other "end" signs appearing after it. It is improbable that the sign denotes a syllable, for it should appear then in more varied positions; or, on the other hand, if it represents a syllable of such a peculiar kind that it can only appear at the end of a word, the instances in which it appears at the beginning cannot be accounted for. There is a general probability that sign No. CLIX is an independent and self-contained unit, that it possesses a meaning in and by itself. In the inscription H 266, it occurs with a single stroke before it; and the similar inscriptions listed under sign No. 1 hardly permit any doubt that here this sign must have a meaning complete in itself.

"End" signs.

Granted that sign CLIX does not form a syllable of a word, but is a separable element, and that it has upon occasion a meaning in itself, it is still impossible to be sure whether this "end" sign is an ideogram or a determinative in most inscriptions. The obvious comparison suggested by inscription No. 287 which has the other "end" sign, No. CCCLXXXVII, does not assist; but it is interesting to note that sign No. CXXVII, with which a comparison is suggested by inscription H 52 can certainly stand alone, as it does in inscription 292. On the whole, it seems possible that sign CLIX is some separate word, at least in most cases.

Inside this group of "end" signs it seems possible to distinguish grades of strength, as it were; and yet no very firm rules can be distinguished. Thus sign CLIX is occasionally followed by other signs; thus by No. CCXCII in inscriptions 554, 387, and 534,[1] by No. CCLXIX in H 250 and 173. An examination of sign No. CCXCII in the list favours the view that this sign represents a word, or at any rate a meaning, in itself; for the form of inscriptions Nos. 550, 386, 355, and 341 points to that conclusion. Similarly, a reference to No. CCLXIX proves that this is another "end" sign, which appears not only after No. CLIX, but after the commonest "end" sign. According to this line of argument inscriptions often end in one or more signs which have separate meanings and do not form part of the preceding words. But it is still possible for these signs to be ideograms, determinatives, or separate elements of personal names, and no aid is obtained for the classification of signs.

"Beginning" signs.

An examination of the "beginning" signs results in the same observation. A remarkable group of "beginning" signs consists of signs modified by two short perpendicular strokes. The signs without the modification can generally vary their position in inscriptions, as in the case of Nos. LXV and LXXIII; but when modified, in the forms LXVI and LXXV, they occur only at the beginning of inscriptions. But it is necessary to note that sign LXXIII is able to stand by itself; it therefore means something. Similarly, a comparison of inscription No. 133 (under sign IX) with inscription 76, and a consideration of the form of the inscription No. 126 leads to the opinion that the modified sign LXXV has a meaning by itself. Of the modified sign No. LXVI it may be affirmed with confidence from H 255 that it has a meaning by itself; but the question whether LXXV has such a meaning does

[1] Erroneously listed under CCXC.—[Ed.]

not at present allow of a certain answer. Now the modified signs LXVI and LXXV are almost always in the initial position. The cases in which they are not in that position allow of a special explanation. If they were ordinary syllables, it is difficult to see why these signs must always be in the initial position; the simplest explanation seems to be that these signs retained in the long inscriptions the separate sense we know they would have. But it remains as difficult to assign these "beginning" signs to one of the three classes as proved to be the case with the "end" signs.

Numeral signs.

There is a peculiar characteristic of the mechanical use of some of the modified signs which must be associated with the nature of the "numeral" signs that have yet to be considered. The commonest, unlisted, "end" sign, when modified in the forms shown by Nos. CCXXXIX to CCXLVI becomes capable of occupying a medial or initial position, while e.g. the modified "beginning" sign CXV can only occupy an initial position as against the medial, initial, or end position of the simple sign CXIV. This mechanical characteristic of the modified signs, which throws them into a forward position as compared with the simple signs, must probably be explained in the same way in both cases. Otherwise it would be plausible to believe that the modification which enables the "end" sign to occupy a medial or initial position represents a vowel, though this would involve the abandonment of the reasoning which has led to the view that the "end" signs represent words in themselves. But this explanation of the modification as a vowel does not serve to explain why a sign which can occupy any position must occupy the initial position when modified.

It is fairly clear that the modification is in itself an entity. That seems the only reasonable explanation of inscriptions Nos. 65 and H 54, listed under sign No. CCCLXXVIII. In these cases the inscription begins with two strokes, in H 54 in the small form that is common as a modification, in No. 65 in the large form which naturally leads to an association with the "numeral" sign; the consecution of signs leaves hardly any doubt that the two forms are identical. The same inscriptions prove that the modifications consisting of one and two strokes are similar in their "mechanical" effect, though not identical. Since one, two, or three small strokes are used as modifications, it is natural to inquire whether their use in this manner is not immediately derived from the sense of the "numeral" signs.

The "beginning" signs modified by two small strokes are often followed by one of the "numeral" signs; it does not seem to matter which of the "numeral" signs is used in this connection. There is a parallel between this collocation of modified "beginning" signs and numeral signs, and the collocation of "numeral" signs, either in repetition or with one another. When the "numeral" signs are in such collocation, it is often, but not always, found that one of the "numeral" signs is written smaller than the other; but no rule has been distinguished in the collocation of "numeral" signs that governs the orders large, small, or small, large, that seem to be used alternatively. It is possible that the "mechanical" nature of the modification, e.g. by two small strokes, is the same as that of "numeral" signs when written small, and this view is rather favoured by inscription No. 113 under sign XV.

Small and large signs.

The question then arises, what is the difference between the small and large writing? It has already been seen that inscriptions Nos. 65 and H 54 show that the difference can only be, if one may use the phrase, in intensity; they can hardly differ considerably in "mechanical" nature. If the "numeral" sign consisting of two strokes is a syllable, then the small two strokes are also a (similar) syllable; if the "numeral" sign is not read, but has some determining function, so has the other, and so forth.

The question of the "mechanical" character of certain "beginning" signs may, then, depend upon a consideration of the "mechanical" nature of the "numerical" signs. The signs composed of strokes are here called "numerical" as a convenient description of their

"material" nature, not because they denote numbers. These "numerical" signs consist of strokes of different lengths, at different angles, arranged in different ways. It would be conceivable that these differences are due to differences of meaning, were it not that an examination of the inscriptions leads to the opinion that this is probably not so. Thus in the case of the arrangement of the strokes, the single example in which the sign with five strokes is not written with the strokes side by side, listed as sign XII, is surely to be compared with inscriptions 301 and 441 under sign XI; the additional element is the "beginning" sign, a separable and distinct part of the inscription that we know can have a meaning by itself. Similarly, the four strokes arranged in two sets of two occur in a connection in X No. 130, which clearly offers a comparison with the four strokes side by side in IX No. 133 and No. 395. These instances do not amount to a logical proof that there is no difference between signs XI and XII, or between signs IX and X; but it must be admitted that, if there was a difference, then that difference must frequently have led to confusion in view of the similarities pointed out, and that it cannot be due to any "mechanical" difference in the nature of the sign. Or again, in the case of the difference between perpendicular and sloping strokes, an inspection of the last inscription listed under VII should show that it must be the same as the last three signs of VI No. 3. Similarly, we may compare VII No. 170 and VI No. 65. It is not easy to believe that there is any difference at all between signs VI and VII of meaning or nature.

Perpendicular and sloping strokes.

It is difficult to explain why these "numerical" signs can change, as is probable, their angle, or, as is possible, their internal arrangement, unless they are numbers. In those scripts where numeral signs can have syllabic, or even word, values, for instance Sumerian, the forms of the signs are not variable, but as fixed and unchangeable as all other signs with syllabic values. Numerals, however, which have no phonetic value, like the Egyptian, can and do change their position in very much the way that these "numeral" signs from the Indus valley do. Analogies of this kind may be extremely misleading. But the changing form of the Indus valley "numeral" signs is a feature which favours the interpretation of these signs as numbers.

Signs for numbers.

Certain of the inscriptions seem most easily explained by the interpretation of these signs as numbers, more especially the shorter inscriptions from Harappā. Under sign No. CCXIX may be found an instance in which the same sign can combine with "numeral" signs containing 2, 3, or 4 strokes and the position of the "numeral" sign varies, being sometimes before, sometimes after sign No. CCXIX. Let it be granted, for argument's sake, that these inscriptions contain words, and that the two signs in these inscriptions form, in the six different cases, one word. The assumption leads to a strange coincidence. It is peculiar that, if the syllable represented by two strokes can be combined with the syllable represented by sign CCXIX in two ways to form two intelligible words, the syllable represented by three strokes should have the same power; it is almost incredible that the syllable represented by four strokes should have the same power. The easiest explanation, the explanation which immediately presents itself, is that in this particular series we have a formula $x2$, $x3$, $x4$, or $2x$, $3x$, $4x$. It is true that even so the indifference shown to the position of the numeral is peculiar. But it may well be that the alternation is a purely graphical one, of the kind sometimes found in our own conventional writings, e.g. £3 or 3£.

Small Harappā signs are older.

The small Harappā inscriptions may well be in a different class from those on the larger seals. They belong to an earlier stratum than the large inscribed seals. Granted that it is possible or probable that in certain cases in the Harappā inscriptions the "numeral" signs may represent numbers, it is not necessary to assume that they always do so. Some arguments against considering them numerals have already been stated. The most important seem to be that the most natural interpretation of inscriptions on seals is that they are names, and that

the regular occurrence of the signs containing 3 and 7 strokes with certain other signs points to a natural sequence of sounds. It must be remembered, however, that these arguments themselves contain assumptions, and need testing before it is admitted that we have any ground for attempting an interpretation of these inscriptions as personal names.

The final result of the examination of the "mechanical" nature of the "numeral" signs is then as inconclusive as that of "beginning" or that of the "end" signs; there is only the probability that in certain cases the "numeral" signs denote numbers, and that the significance of the stroke modifications of some "beginning" signs is closely connected with the corresponding "numeral" signs. There is a further parallel between the modifications and the "numeral" signs that may be of importance. A comparison of the signs CCXLIV and CCXLV with CCXLII and CCXLIII seems to show that there is no important difference in the meaning of these signs, or in other words that the modifications can in certain cases be perpendicular or aslant, as is true also of the "numeral" signs.

Strokes at beginning or end.

It is impossible to be certain of the character of these inscriptions until we know whether they consist of one or more words, and of that there is no indication. But a "mechanical" analysis tends to point to certain conclusions; the typical series of instances listed under sign No. CCCXXXI will provide an example of the kind of analysis meant. H 3570 seems to show that the sign can in itself mean something. It can combine with the "numeral" signs with six or seven strokes to mean something. With two strokes in front and the separable "end" sign after, it forms a significant group in H 152. When sign No. XXVIII intrudes before the "end" sign into this group, it is permissible to infer that another separable element is present in inscription No. 120, an inference much favoured by considering the inscription No. 5 listed under sign XXVIII, since the intrusive sign and the "end" sign make a significant group. The most natural, though not demonstrable, conclusion is that in inscription No. 120 there is a series of signs which retain their separate characters; in other words, the inscription consists of a series of intelligible expressions. If the whole is a personal name, then on this reasoning it contains four separate ideas. Similarly, in inscription No. 19 we have "beginning" sign + 4 strokes + fish + "end" sign, again conveying four separate ideas. But in those inscriptions where "numeral" signs occur before the fish, 2, 3, 4, 6, and 7 strokes are to be found. So far as we know at present, the non-appearance of the other "numeral" signs may be accidental; in any case the "numeral" signs appear to be significant in themselves.

Analysis of an inscription.

If we now consider inscription No. 314 we shall find that it consists of at least five elements that seem to have a separate significance, possibly six. There is the "end" sign, preceded by the fish, with six strokes in front of it; before these, as the second sign, comes sign No. CCLX, with the "modifying" element of two short strokes already discussed. Of sign No. CCLX it may fairly be assumed, from a comparison of inscriptions Nos. 268, H 21, and 372 that it has a separate value in itself. The first sign in inscription 314 is sign No. CXXXIX, and about this sign there is a curious observation to be made. It occurs upon a broken pot, and it is therefore not absolutely certain that it stood above; it may have done so. The sign also occurs on pots from the Aegean region, of the kind called "Urfirnis" ware, see e.g. Hall, *Civilization of Greece in Bronze Age*, fig. 68, dating from about the middle of the second millennium, but is to be seen on much earlier ware, *ibid.*, fig. 31. It also appears commonly on the "Dipylon" ware from Attica of about the ninth century. The usual interpretation of its appearance on Aegean ware is that it is used as a decorative motif to fill in blank spaces. It is not necessary to deny this interpretation, but it is to the point to remark that in certain cases it appears in a connection in which it seems to have a particular meaning. Thus on the "Dipylon" pots illustrated in *Cambridge Ancient History*, pl. i, p. 282, it is placed in many blank spaces of a scene depicting a naval battle in a manner that suggests an

interpretation; the signs may denote objects carried in the boat as articles of commerce, and emptied out when the crew were thrown out. The most natural interpretation of the sign on pots would be that it denoted the stuff they contained, or the measure they could contain. Curiously enough, this sign, placed sideways, appears in the Sabæan alphabet as the letter *zayin*, the meaning of which is much disputed; the older interpreters believed the word meant a kind of weapon, but more recent authorities have advanced widely divergent views. There is a Cretan sign which closely resembles the Sabæan *zayin*, but there is an important difference in that a small horizontal stroke is attached to the centre of the sign in such a manner that it is reasonable to see in this Cretan sign a representation of the double-axe. The shape of the sign is peculiar, though the opinion that the sporadic occurrences are due to accident rather than borrowing will doubtless appeal to some.[1] But at least a possible interpretation of all this evidence is that sign No. CXXXIX depicts some material commonly contained in earthenware vessels, which was carried far and wide over the ancient world, even by sea, for very many centuries; this interpretation does not impose itself, but is to be borne in mind as a possibility.

Cretan sign.

Sign depicting some material.

It may be, then, that inscription No. 314 consists of a series of five signs, each having a separate meaning. An analysis of longer inscriptions would show that they contain an even larger number of elements. But it is first necessary to mention a very important fact in this script, namely, that the greater number of the signs in this list occur only once or twice, and a considerable increase in the number of inscriptions would result in an increase in the number of these rare signs. The form of the inscriptions in certain cases proves that these signs are capable of standing alone; a clear case may be found under Nos. CL and CLI. It is extremely probable that these signs are for the most part ideograms. In many cases they occur alone immediately before a "beginning" sign or after an "end" sign. Two typical instances will serve to illustrate this, listed under sign No. CXV, viz. inscriptions Nos. 324 and H 148. The first, No. 324, consists of a group of three signs and an end sign, preceded by a "beginning" sign, which also occurs in H 148 but with a different "end" sign. In front of the "beginning" sign in both inscriptions there are other signs. That which appears in No. 324 occurs in one other inscription, also as the first sign. The second sign in H 148 occurs also in one other inscription, at the end, in a group of three signs of very rare occurrence. The first sign in H 148 is sign No. CLXXX which is probably identical with sign CLXXXI; it occurs five times, in various positions, sometimes before or after an "end" sign, inscriptions No. H 164, H 146, and 106. There is no logical proof to be adduced in this matter; but there is a strong impression that these signs are separate and distinct from the groups which follow them; in other words that they are ideograms. As to the signs which follow the "end" sign in H 148, the inscriptions listed under sign XLIII are sufficient to show that the penultimate sign has a sense in itself, since it appears alone before the "end" sign, and has a sense which frequently requires it to appear after the "end" sign. As to the last sign, it belongs to a group of signs consisting of strokes with a varying number of small strokes attached, the ideogrammatic nature of which is fairly clear; an observation of such cases as inscriptions Nos. 339 and 116 points to this inference for the group.

Many signs rarely used.

Signs as ideograms.

Signs in various positions.

There seems a vague, and indemonstrable, probability that a not inconsiderable proportion of these signs are ideograms; but even so there are many difficulties to be considered. For instance, the sign which seems to resemble a table with a cloth on it, No. CCCXXII, appears at the end, sometimes after the commonest "end" sign, of all the listed inscriptions save one, No. 440. In that case the signs exactly reverse the order of the last three signs in No. 435. Were it not for inscription 440, the explanation of

[1] The sign occurs at Selima in the Libyan desert, *Antiquity*, 1928, p. 283.

sign CCCXXII as an ideogram would fit. But if inscription 440 were reduced to three ideograms to accord with this, inscription 435 would necessarily be reduced to the first two signs, and three ideograms, thus severing the sign with seven strokes from sign No. CCCIV. But this seems inadmissible, because the sign with seven strokes is very closely connected with this sign, as in inscriptions Nos. 211, 113, H 11, and H 8, a connection that cannot be accidental if sign No. CCCVIII be considered as a development of No. CCCIV. There is a mass of material of this kind in these inscriptions, and until certain proof is forthcoming it will remain very problematical whether any sign is certainly an ideogram. But the expression of a purely personal opinion may be allowed, namely, that the evidence points to inscription 435 being a succession of separate words.

Suggested separate words on inscription.

If this view is not altogether mistaken, then it has a certain relevance to the assumption that these inscriptions contain proper names. It must, under this assumption, be granted that the inscriptions do not all contain only personal names; there must be other elements as well. Secondly, it will be evident that in certain cases the name is expressed by one single sign. This may be seen from the two inscriptions listed under sign No. CXXIII. In the first of these, the form of the inscription clearly shows that the sign belongs, in its "mechanical" nature, to the class tentatively considered ideograms. In the other inscription there are only two signs; and unless we are to assume that the ideogram which apparently forms a description of the name in one class can with the same or a different sense be part of a personal name in the second—which is possible, but unlikely in view of its comparative rarity in this large number of inscriptions—the personal name is reduced to a single sign. Thirdly, some of these names include rather peculiar ideograms. One of the most obvious pictograms in this script is the chair (No. CCCXIX). It is true that this is not beyond all doubt an ideogram, but a glance at the first three inscriptions listed under No. LXXX is sufficient to show the possibility that it is such. Now a chair may naturally, as an ideogram, represent very diverse meanings, but it is of rare occurrence, and it seems most probable that a rare pictogram would retain one meaning closely allied with its origin. If this formed part of a personal name, then that name must belong to a language which must be classed in this respect with a very limited group. One inevitably thinks of certain English and German personal names; the mere comparison is instructive because it shows how limited this type of name is. If on the other hand, the chair represents a prefixed title, the group of languages concerned is again probably a small one. Again, in certain cases very obvious pictograms, e.g. of a bird, are repeated. One expects the repetition in such a case to denote a plural (or at least a dual). Men are often called by the names of birds or fowls, but the plural seems unsuitable for a personal name.

Not only personal names on inscriptions.

A fourth consideration must involve the difficult question of the longer inscriptions, of the kind exampled by No. 400, listed under sign No. LXXV. This consists of three lines, of which the first and second each have as the last sign a common "end" sign; and there is nothing in either line separately to distinguish them from single-line inscriptions with the same "end" signs. We should expect two personal names on a seal either to be joined by the word or words "son of", or by some grammatical inflection which should denote that relation. Yet in all these inscriptions it is impossible to single out any constantly recurring sign or group the position of which "mechanically" points to such a meaning. Certainly the third line of inscription, No. 400, might be so interpreted; but it presents no striking analogy to groups in other long inscriptions, and therefore such an interpretation would not be probable. Much could be written of a speculative nature on this subject; thus it might be suggested that the grammatical relation of the first and second "names" is expressed by the very same grammatical form as that in which the names appear. If, for instance, the language possessed a genitive, then it is conceivable that the second name is a genitive after the first

Long inscriptions discussed.

name, and that all the names appear in the genitive, owing to some unexpressed idea like "property of". Nevertheless, these long inscriptions are a very considerable difficulty for any "mechanical" explanation of these inscriptions as personal names, or even as personal names and titles. It does look as if these long inscriptions were lists of words, or word-groups; and some other hypothetical explanation than that of personal names would suit the case better.

The attempted examination of these signs so far has led to the conclusion that most of them have meanings by themselves, and that some are probably "ideograms", in that they convey a word as an idea, and are therefore not used with syllabic values. Are there any that can be shown to have syllabic values? That unfortunately is beyond the limited means of analysis at our disposal. Those signs which are constantly found in recognizable groups may well be syllabic, but it is at present impossible to be sure that the extraordinary permutations and combinations possible for a sign like No. CCCLX (a bird of some sort) really prove that it is such. Indeed, this variety of order that is possible renders one extremely doubtful of such an explanation in the case of the "fish" sign and its modifications.

Division of Indus signs into classes difficult.

At present, as has already been said, the difficulties of dividing these Indus signs into classes are insuperable. There is a general probability that most of them could have a meaning by themselves and that some are pure ideograms. Were it possible to be sure that these inscriptions were personal names, more might be said, for an examination of the inscriptions proves, to the present writer, that those names were marked by a series of peculiarities which must be very rare. But there could be no more dangerous hypothesis at present. The arguments that have been adduced against considering the "numeral" signs as numbers can at least be countered by the observation that in certain cases they almost certainly do represent numbers; and the assumption that they are numbers might even be reconciled with the hypothesis that the inscriptions contain personal names—which would be of considerable importance, for we know a language that not infrequently contained numbers in the personal names. But it is safer to believe that these inscriptions may in fact have an import quite other than personal names. The analogy of the devices of certain Indian coins to the devices of these seals has already been mentioned. It is fitting to note that certain themes in these signs may be compared to the punch-marks on those coins; thus, for example, the little man who brings along two hooks, if the description may be allowed, is strikingly similar to the little man of the punch-marks, who holds a hook in either hand. It is disappointing, but wise, to admit that these inscriptions may in fact mean, on the present evidence, almost anything. An open-minded consideration of the evidence led, in 1924, to the conclusion that the similarity of some of these signs in form (not in use or meaning) to Sumerian signs showed an early connection between Sumer and the Indus valley. That connection has since been conclusively proved to have existed. An open mind may equally find very close and remarkable similarities between some of these signs and the marks (*wasm*) of Arab and African tribes; such signs have also been found at Selima in the Libyan desert. Some will certainly hold that the resemblances are accidental. They may equally be due to a traditional use of certain trading marks which has lasted until a comparatively recent period.

Arab and African signs similar to those of the Indus.

N.B.—In the Sign Manual on Pls. CXIX–CXXXIX, the letter H attached to the reference number of an inscription signifies that the inscription in question comes from Harappā, and that the seal or other object on which it occurs is not illustrated in this work. All other inscriptions come from Mohenjo-daro and, with very few exceptions, are reproduced in Pls. CII–CXVI. The exceptions referred to are distinguished by the letter S.

The following corrections should be made in the Sign Manual:—Pl. CXXV, Col. 4: delete Sign CCLXVII; *ibid.*, Sign CCLXX: delete Inscr. H 329, the correct reading of which is as shown under Signs CCLXIII and CCLXVI; Pl. CXXVI, Col. 3, Sign CCXC: the last sign of Inscr. 534 is No. CCXCII, not No. CCXC. The latter sign should therefore be deleted.—[Ed.]

CHAPTER XXIII

THE INDUS SCRIPT

FOREWORD

IN this study of the inscriptions of the early seals of the Indus Valley I have definitely stated that the early Indian alphabet, known as the *Brāhmī script*, is derived from the ancient Indus pictographic writing, and I have identified the origin of many Brāhmī characters with confidence. In my *Sign List* the phonetic values of the derived alphabetic characters have been inserted, but I do not wish to convey the inference that these are the correct values of the original ideograms, any more than the phonetic values of the Phœnician alphabet represent the values of the Egyptian pictographs from which they are derived. It is highly improbable that the signs of the Indus script have reached the syllabic stage, that is, a consonant + vowel, as in the Brāhmī alphabet. Many of them may possibly be so used, and used as phonetic elements in the writing of the words, as many Sumerian pictographs are in the oldest known Sumerian texts. If the roots of this unknown language are mainly biconsonantal, as in Sumerian and Indo-Germanic languages, then it follows that the syllabic values, such as *ba*, *ta*, *ga*, etc., of the derived Indian alphabet, have lost a final consonant, and may have been *bad*, *bag*, *ban*, etc., *tad*, *tag*, *tab*, etc., *gal*, *gan*, *gab*, etc. It is no more possible to transliterate the Indus signs from the derived Brāhmī alphabet than to operate in the same manner upon Egyptian hieroglyphs with the derived Phœnician alphabet. Here we have, already from the seals, a sign list approaching 300 numbers[1]; obviously the initial consonants of a very restricted proportion would be known, even in the successful identification of all the forty-five Brāhmī characters.

Indus writing the original of Brāhmī script.

Transliteration of the Indus script from the Brāhmī not possible.

The proper names and names of professions on these seals do not supply sufficient material for successful decipherment. It is not possible to separate word and sign groups; the declensions and verb inflections cannot be detected here, and the pronouns are entirely absent. Until longer inscriptions of a literary and historical character are discovered, not much advance in the interpretation can be expected. A good many important facts can be determined, however, to clear the ground for more satisfactory research. In the first place this script is in no way even remotely connected with either the Sumerian or Proto-Elamitic signs. I have compared some of the signs with the signs of these scripts. For the references to the Sumerian pictographs, or the earliest forms of the Sumerian signs,[2] I have referred the reader to the numbers of *REC.* (Thureau-Dangin, *Recherches sur l'Origine de l'Écriture*

Indus script unconnected with Sumerian.

[1] It should be noted that at the time of writing this chapter (it was finished in April, 1927) Professor Langdon did not have access to all the inscriptions utilized by Messrs. Sidney Smith and C. J. Gadd in the preparation of their sign manual.—[ED.]

[2] But see the Postscript (July, 1928).

Cunéiforme), and for the Proto-Elamitic signs to Professor Scheil's "Textes de Comptabilité Proto-Élamites", in vol. xvii of *Mémoires de la Mission Archéologique de Perse*, pp. 31–66. This series is commonly cited as *Dél. Per.* (*Délégation en Perse*). The Indus inscriptions resemble the Egyptian hieroglyphs far more than they do the Sumerian linear and cuneiform system. And secondly, the presence of detached accents in the Indus script is a feature which distinguishes it from any of these systems. Although vowels must be inherent in all the signs, nevertheless some of the signs and accents must be pure vowel signs. For this reason alone it is necessary to resign further investigation to Sanskrit scholars. If future discoveries make it possible to transliterate the signs, and the language proves to be agglutinative, it will then be a problem for Sumerologists. I am convinced that all attempts to derive the Brāhmī alphabet from Semitic alphabets were complete failures.

Indus signs resemble Egyptian hieroglyphs.

* * * * * *

This study of the script of a pre-Sanskrit civilization of the Indus Valley is made from the material supplied by 541 impressions of small press seals. Five hundred and sixteen were supplied to me in photographs by the Archæological Department of the Government of India, together with photographs of several more which are not inscribed. The remainder consists of photographs of seals (not of the impressions), published by Sir John Marshall in the *Illustrated London News*, 1924, pp. 624 ff., and 1926, p. 346; in *Cambridge History of India*, vol. i, pl. xi (two seals); and in the *Archæol. Survey Report*, 1923–4, pl. xix, 15 (one seal). Three seals found at Harappā (1872, 1885, 1886) were published by J. F. Fleet in the *Journal of the Royal Asiatic Society*, 1912, pp. 699 ff., and five have been found in Mesopotamia. Since the archæological criteria for dating prehistoric monuments in Mesopotamia and Elam are much more secure than in India, they constitute the most valuable evidence for dating the early civilization of the Indus Valley.

Indus seals found in Mesopotamia and Elam.

One of these five seals is a bone roll cylinder found at Susa, apparently in the same strata as that of the tablets in Proto-Elamitic script of the second period of painted ware. Scheil, in *Délégation en Perse*,[1] vol. xvii, assigns this group of tablets and painted pottery to the period of Sargon of Agade, twenty-eighth century B.C., and some of the tablets to a period as late as the twenty-fourth century.[2] The cylinder was first published by Scheil in *Délégation en Perse* ii, 129, where no precise field data by the excavator are given. The text is there given *as it appears on the seal*, and consequently the text is reversed. Louis Delaporte in his *Catalogue des Cylindres Orientaux . . . du Musée du Louvre*, vol. i, pl. xxv, No. 15, published this seal from an impression, which gives the proper representation of the inscription. Now, it will be noted that the style of the design is distinctly *pre-Sargonic*: witness the animal file and the distribution of the text *around the circumference* of the seal, and not parallel to its axis as on the seals of the Agade and later periods. See the pre-Sargonic seals of Lugalanda, *Revue d'Assyriologie*, vi, 105–25, by Col. Allotte de la Fuÿe; seal of Eniggal by the same scholar in *Documents Présargoniques*, pl. ix; Delaporte, *Cat.*, ii, pl. lxx, No. 3. It is certain that the design known as the animal file *motif* is extremely early in Sumerian and Elamitic glyptic; in fact it is among the oldest known glyptic designs.

Animal file motif one of the oldest designs.

But the two-horned bull standing over a manger was a design unknown in Sumerian glyptic, except on the small round press seal found by De Sarzec at Telloh and published by Heuzey, *Découvertes en Chaldée*, pl. xxx, fig. 3*a*, and by Delaporte, *Cat.* i, pl. ii, t. 24.

Two-horned bull not known in Sumer.

[1] This title no longer appears on the title page of the official publications, which are now called *Mémoires de la Mission Archéologique de Perse*.

[2] See my review of Scheil's latest study of the Proto-Elamitic script in *JRAS*. 1925, p. 169.

The Indus seals frequently represent this same bull or bison with head bent towards a manger. See Seals 317, 318, 319, etc. Two archæological aspects of the Susa seal are disturbing. The cylinder roll seal has not yet been found in the Indus Valley,[1] nor does the Sumero-Elamitic animal file *motif* occur on any of the 530 press seals of the Indus region.[2] It seems evident, therefore, that some trader or traveller from that country lived at Susa in the pre-Sargonic period and made a roll seal in accordance with the customs of the seal-makers of the period, inscribing it with his own native script, and working the Indian bull into a file design after the manner of the Sumero-Elamitic glyptic. The Susa seal clearly indicates a period *ad quem* below which this Indian culture cannot be placed, that is, about 2800 B.C.

Pictograph of Indus seal from Susa.

On a roll cylinder it is frequently impossible to determine where the inscription begins and ends, unless the language is known, and that is the case with the Susa seal. However, I have been able to determine a good many important features of these inscriptions and I believe that this text should be copied as follows :—

The last sign is No. 194 of my list, a variant of No. 193, which is a post-fixed determinative, denoting the name of a profession, that is " carrier, mason, builder ", and invariably stands at the end. (The script runs from *right* to *left*.)

Indus seals found at Telloh and elsewhere.

As to the small *circular* press seal found by De Sarzec at Telloh (Lagash),[3] a site in the extreme south of Sumer, which has furnished monuments anterior to 3000 B.C., here again no archæological data have been preserved concerning the stratum in which it was found. The text here follows the upper circumference, and for similar round and oval seals from Harappā and Mohenjo-daro see Seals 309, 478, and 527. It is extremely probable that this seal also belongs to the *pre-Sargonic* period, and it is regrettable that no exact information is available from the field notes of the excavator. The material is a " soft grey greenish " stone. The text is :—

The postfix No. 87 has here a more archaic form than on any of the seals from the Indus Valley.

A small square press seal of steatite of the usual Indian type has been acquired by the Louvre and published by Dr. F. Thureau-Dangin, *Revue d'Assyriologie*, xxii, 99. He suggests that it came from Telloh also. The text is :—

The last sign is No. 195, a postfixed determinative of a profession. The fourth sign may be nothing more than No. 219, the accretions being due to defects on the surface of the seal. The animal on this seal is the Indian tiger with head over a manger, facing right, as in Seal 351 ; cf. Seals 350, 353, and 355.

The impression on clay of a similar seal was found at *Djokha* (Umma) near Telloh, a site which has supplied no antiquities later than the twenty-fourth century B.C., and many

[1] The cylinder seal has since been found at Mohenjo-daro.—[ED.]

[2] This motif occurs, however, on the sealings, e.g., Pl. CXVIII, 10.—[ED.]

[3] Published by Delaporte, *Catalogue des Cylindres, Louvre*, i, pl. ii, t. 24.

of the greatest antiquity. This seal has the usual horned bull[1] over a bowl-shaped stand surmounted by a box as in Seals 40 and 115. The reverse of this clay tag from Djokha is impressed with another seal bearing the same simple design of a surface ruled in small squares as found on the Indian seals; see *Revue d'Assyriologie*, xxii, 56, and compare Seals 524, 525, 526, and 528. Professor Scheil, however, thinks that this is only the impression made by a coarse cloth. The inscription on the Djokha seal is:—

Here the text ends with the postfix No. 96.

Of the four Indus Valley seals found in Mesopotamia, that excavated by Mr. Mackay in the temple of the war-god Ilbaba at Kish is the only one concerning which exact field records exist. It came from a chamber in the temple beneath the Samsuiluna pavement and is described as found lying in the débris used to fill up the foundation of the chamber. A plaster copy is published by Mr. Mackay in the *Journal of the Royal Asiatic Society*, 1925, pl. x. It was originally covered with a blue glaze. The text is:—

The postfixed determinative No. 182 shows that the text bears the name of a person, or profession.

Indus seals of Mesopotamia are pre-Sargonic.

However these five seals may have arrived in Mesopotamia and Elam, it is obvious that they are *pre-Sargonic*, that is, earlier than the twenty-eighth century, and consequently the civilization of the Indus Valley may be as old as that of Sumer and Egypt. I make no comment on pottery as inadequately known to me, but the statuette published by Sir John Marshall in the *Illustrated London News*, 1926, p. 343, is so entirely un-Sumerian that any close racial connection must be dismissed at once. The familiar design of a bull, buffalo, elephant, rhinoceros, and tiger before a manger or sacred symbol is also unknown in Sumerian and Elamitic glyptics. The survival of the *svastika* design on Seals 500 to 515, a religious symbol characteristic of India, suggests that perhaps other survivals may be found, which will enable us to interpret the script also. For I hardly believe that there can be any doubt concerning Sir A. Cunningham's brilliant suggestion of an early Indian pictographic system as the origin of the Brāhmī alphabet.[2]

Racial connection between Indus and Sumer unlikely.

Cunningham on Indian pictographic writing.

Bühler's theories.

The origin of the Brāhmī monumental script of the Aśoka Edicts has been the subject of numerous theories. They are summarized by Georg Bühler, *On the Origin of the Indian Brāhma Alphabet* (1898), and in his standard German work *Indische Palæographie*, p. 10 (1896).

Cunningham's suggestion was the first one put forward as an explanation of the origin of the Sanskrit Nāgarī alphabet. It has been derived from the Phœnician alphabet by Weber and Bühler, from the Sabæan-Himyaritic alphabet by Isaac Taylor and from the cuneiform syllabary of Assyria and Babylonia by Deecke. The comparisons of individual signs of the Brāhmī script of early Indian epigraphy, which dates from 350 to 220 B.C., with the letters of the Phœnician alphabet on the one hand, or with those of the Himyaritic alphabet on the

[1] Only one horn is shown on the design, which is merely a usual method of glyptic common to Sumerian seals also; one horn is hidden behind the other. See *Revue d'Assyriologie*, xxii, 100, n. 1. See, however, pp. 68 ff. *supra*.—[Ed.]

[2] *Corpus Inscriptionum Indicarum*, i, 52.

other, do not inspire much confidence in those theories. Their advocates claim "obvious connections" between certain syllabic signs of the Brāhmī script and certain letters of the two Semitic alphabets with an enthusiasm altogether unwarranted.

In approaching an epigraphical and linguistic problem so difficult as that presented by the new script of the Indus Valley, the chronology and nature of the script must first be settled. The evidence for a minimum date, twenty-eighth century B.C., has been stated above. Is it then reasonable to suppose that this pictographic script of ancient India survived without any archæological evidence of its existence during the long interval between the age of the seals of Harappā and Mohenjo-daro and the age of Aśoka in the third century B.C.? Obviously the geographical and historical aspects of the problem favour an ancient Indian pictographic system as the origin of the alphabet finally adopted by the Āryans of India.[1]

In my sign list I have compared some of the signs with early Sumerian and Egyptian pictographs, and a few comparisons with Himyaritic-Sabæan letters have been made. I do not wish the reader to infer that I believe in any actual connection between the signs thus compared. The similarity is due to pure hazard, such as is bound to occur in pictographic scripts. The script as represented by the Indian seals is more like the Egyptian pictographic system than any other known script. As in the case of the earliest Egyptian inscriptions, this Indian script is already standardized; a large number of the original pictographs have been reduced to neat monumental forms, which indicates a long period of evolution. It will be seen in the subsequent pages that the writer believes that the early syllabic alphabet of Northern India, known as the Brāhmī script, from which all later characters were derived, is most probably a survival of the early pictographic system of the Indus Valley. But even though future discoveries confirm this thesis, it does not follow that the language of the early Indus Valley seals is Indo-Germanic; the Babylonians borrowed the Sumerian ideographic and syllabic script for writing their Semitic language and the same circumstance may have obtained in India.

Great antiquity of Indus pictographs.

Brāhmī script derived from Indus writing.

The Indus script runs from *right* to *left*. The Sumerian pictographic writing also ran from right to left. Nothing can be determined in this respect about the Proto-Elamitic writing; for it has been preserved in lists of objects only, and consequently its signs are written in columns. The direction of the writing of the Indus script from *right* to *left* is proved by the following facts[2]:—

Indus writing from right to left.

1. All the pictographs face to the *left* with the sole exception of the *homo*-signs Nos. 189, 196*b*, 201, 204, and there is certainly some good reason for this. These signs convey some such sense as "retreat, defence, ward off, backward, behind". For signs facing *left*, see Nos. 74, 165–74, 250. It is curious that the *fish*-signs, 175–80, and most of the *homo*-signs are drawn *en face* in the old perpendicular style.

2. But even more conclusive is the *internal evidence*. The determinative No. 87 stands at the left end of a large number of the lines. Now if the *left* were not the *end* of the line, how can we explain a text like that in Seal 52, where the material is too much for one line, and runs over into the second line by one sign? This is the postfix No. 87 and stands immediately below the *left* end. If the line began on the left this sign would stand at the left end of the line. Again, compare the text of Seal 554, where No. 30 stands just below the left end, and Seal 355 where it again stands below the line. That this sign is the ending is made certain by Seals 386, 387. The text on Seal 302 is interrupted by the

Internal evidence.

[1] Indian tradition, at any rate, places the invention of writing as early as the end of the fourth millennium B.C., 3101, and ascribes it to the creator Brahmā. See Fleet's edition of Bühler's *Indian Palæography*, p. 1.

[2] Cf. also Mr. Gadd's observations on this subject in the preceding chapter.—[ED.]

bull's head and continued below with Nos. 57, 87. It is certain from the repeated occurrences of No. 87 at the left ends that it is either a prefix or a postfix. But were it a prefix and the writing to be taken from left to right, clearly it must stand where No. 237 is there placed. It will be observed that, when a line is broken by the design, it is continued below on the *left* side; see Seal 167. Finally, compare Seal 101 with Seal 247. Here is a clear case of boustrophedon, the second line *returning* in the order Nos. 48–87, as it appears on Seal 101.

3. When the text contains one line and a second incomplete line, the second line runs from *left* to *right*, or boustrophedon. A good example was cited above by comparing Seal 101 with Seal 247. For No. 99 at the end of a one-line text, see Seals 101, 102, 396, and 413. Compare Seal 126 with Seal 340; No. 214 stands next to the last line in Seal 126; but on the two-line text in Seal 340, the second line of which has only two signs, No. 214 stands first, which indicates boustrophedon. On the other hand, a text having two or more *complete* lines is not boustrophedon. See Seals 12 and 321, where No. 220*b* stands at the left end of line two, and compare Seal 397, where this sign ends the word. The longest text is that of Seal 400, where line two ends with the usual postfix 87, and line three with No. 153, which also has the last place in Seal 471; and often at end with postfix 87. But Seal 329, on which the three signs in line two are a continuation of line one, is probably boustrophedon, No. 237 standing at the right end in the last place as in Seal 302. No. 126 comes first in Seal 139, line two, and note that this sign usually comes first on one-line texts. It is also certain that if (which is very probable) Seals 435 and 440 are parts of one and the same text, the Seal 440 is boustrophedon of Seal 435, from the position of No. 98*c*, always last, and of No. 5, usually first.

Accents

Accents in Indus writing. Signs syllabic, writing phonetic.

A. ('S.) The most extraordinary feature of this script is the accents added to a large number of letters, and the simple accents are invariably at the left side, which shows that the ideogram or syllable ended on the *left* in the pronunciation. I am of opinion that most of these signs are *syllables* and that the writing is phonetic, with the exception of certain determinatives. The accent ('S) is added to Nos. 87, 88, 97, 118, 124, 153, 154, 233, 264, that is, to the signs which most frequently occur at the end of words, and elsewhere. Since its doubled forms (" or ¦) suggest the sibilant *Visarga* of the Sanskrit, it is tempting to compare this accent with the Sanskrit *Anusvāra* [1] or nasalization of a vowel ending.

Analysis of accents.

Since the accent ('S) occurs with so few signs in the Indus script, it can hardly be the common accent for nasalization. But it is curious that this short stroke, when added to the Brāhmī characters for A and I, indicates the *long* vowel; and note that this same stroke may be added to signs Nos. 47 (50), 125 (130), *attached* and not standing free from the sign.

No. 47, especially the form 48, is so similar to the Brāhmī syllable sign *ma, mo* that they may be identified.[2]

B. ("S or ``S.) By doubling the accent A the most frequently employed inflection of a syllable or ideogram (") is obtained. It is found with Nos. 47, 68, 87 (89, written inside), 95, 113 (114), 120, 126, 129, 131, 149, 153, 167, 187, 199*b*, 200, 232, 233, 234, 238, 264; also 72 is probably an example, cf. 89.

[1] Placed over the sign.

[2] My references to the Brāhmī characters are taken from Georg Bühler, *Indische Palæographie*, Tafel II *with Umschrift*. It is possible that Nos. 47, 48 are different signs and consequently only No. 48 can be compared with *ma, mo*, No. 32 of Bühler's list.

No. 87 is probably the Brāhmī sign *la*, *B*. 35 [1] ; No. 113 is *B*. 23, *ta* ; No. 125 is *B*. 30, *ba* ; Nos. 126 and 232 are modifications of this sign and so perhaps No. 11. Now No. 11 resembles *B*. 30, *bo*, and No. 6 *B*. 30, *bā* ; No. 129 without accent *B*. 30, *bī* ; these accents would then be not *vowel prolongations*, but something in the nature of the *dot* over a letter indicating nasalization, and the sign : (*Visarga*). In other words, one stroke added to the simple sign *ba* would produce *bā*, and two strokes added produce *bo*, *bū* ; in this case *ba* = 125 (simple sign) ; *bā* = No. 6 ; *bo*, *bū* = No. 11 ; *bī* would be produced by adding three strokes, 129 (= 26).

In case of the sign for *ma* 47 and 48, No. 50 should be *mā*, corresponding to *B*. 32 VI, XIX, XX. No. 49 is made by adding *two* strokes one above and one below, producing a straight line, and this is *B*. 32 XXII + XXIV *mo*, and *B*. 32 VII *mo*, where the two strokes are added at the right. I would therefore read No. 87 *la* ; 88 *lā* ; 89 *lū*, *lo* ; 90 *lī*. No. 224 should then be *bā*. But how then should *bi*, *bu*, *be* (short) be expressed if the simple sign is *ba* ? No. 132 is surely *B*. 8, vowel *o*, and No. 133 may be the same sign reversed. In that case Seal 195 would end in *la-o*, assuming that this script had reached a purely syllabic stage. If it had not, then different signs may have stood for *ba* and *be*, etc., as in Sumerian, and the suggestion that strokes are added to signs for vowel prolongation is entirely erroneous, this being a principle of the derived Aśoka script only. No. 6, for example, may resemble *B*. 30 XI (*bā*) by accident only. I am inclined to believe that this suggestion is not on the right track, and that the signs 6, 11, 26, 129, for example, have no connection with Nos. 125 and 219 as base forms.

Suggestions for reading.

Detached accents.

The *detached* accents, however, are clearly not all vowel prolongations ; for several vowel signs of the Brāhmī script are obviously derived from the Indus script, and these are probably employed for vowel prolongation in this ancient writing, as the same vowels are employed in Sumerian, or for a final elided letter, or for indication of case and mood. Vowel *o*, *B*. 8, has been identified with Nos. 132–3. Vowel *i*, *B*. 3, is clearly No. 269*b* ; vowel *e*, *B*. 7, is most likely 219 ; and the character given as doubtfully *ī*, *B*. 4, is No. 274*b*. The Brāhmī character for *a*, *B*. 1, I suggest, comes from the *homo*-signs 193–4, turned 90° to the *right*.

C. (``S".) Accent B may be placed on each side of a letter, which I take to be one of the glides , , or *h*, see under D. It occurs with No. 1 (see No. 25) (between two signs).

D. (¦.) Several signs are accompanied by this detached accent which is A doubled perpendicularly and resembles the sign *Visarga*. It occurs with No. 156*c*, and the *fish*-sign, No. 175, is followed by D + B on Seal 373.

E. (¦S¦.) Much more frequent is the accent D placed *before* and *after* a sign, representing probably the on and off glide, which according to the nature of the spoken language may be the " check " on and off glide (,), *Aleph* of the Semitic languages, the sonant glide (ʿ) *Ayin*, or the fricative rough on and off glide (*h*), *hê*. This does not assume that a *syllable* or *word* represented by a sign so accented begins and ends with a *vowel only*. It may occur with liquids and nasals, spirants and explosives. See Sievers, *Grundzüge der Phonetik*, pp. 150–8. This accent occurs with Nos. 163 (standing *between* two signs), 175*b* (at end), 176*b* (between two signs), 178*b* (*at end* and *between* two signs), 220*b* (always last).

F. (¦¦S¦¦.) Accent C doubled perpendicularly on both sides of the sign, which suggests the vowel I, No. 274*b*. On Seal 74, No. 153, would be preceded by *i* and followed by *ī*. Since No. 162 is probably *B*. 18 (*ṭa*), the Seal 296 would read *i-ṭa-i-la*, or if No. 162 in the original script had a final consonant, *iṭa* (?) *ila*, assuming that the Brāhmī alphabet is taken from the first consonant or vowel of a word represented by an ideogram. This accent

[1] *B*. refers to Bühler's list.

(or sign preceded and followed by vowel *ī ?*) occurs with Nos. 96*d* (at beginning), 102 (at beginning).

G. (¦¦ S.) The accent C doubled perpendicularly, only at end of the sign, with 232*c*. It will be noted that No. 232 occurs with accents *B* and *G*. I take *B* for an *off glide*, and *G* for the vowel *i*. These forms occur repeatedly at the beginning of names and are probably prepositions or determinatives.

H. (*Y* or *Y*.) Accent A after slanted line. With Nos 47 (at beginning), 99, 118, 131, 153, 160*b*, 233*d*, 240 (264*b*, I do not understand this form).

I. (Ŝ.) The circumflex accent placed over a sign occurs with No. 96*b*, which I identify with *B*. 12, *gha*, but the effect of the accent is entirely obscure. Also over No. 177 and combined with accent E, No. 177*b*, No. 181.

J. (S̅.) This superimposed accent occurs with Nos. 1 (25), 53, 98, 120, and 120 is also accented, J + B and J + E.

Determinatives

Determinatives probably not pronounced.

There are certain signs which are obviously determinatives, and as such are naturally not accented ; for, as in Sumerian, they were probably not pronounced. They may stand either *before* or *after* the name. Since the seal inscriptions are surely names of persons or professions, or both, the material now at our disposal contains only a small number of the determinatives, which must have existed, such as the signs for "stone", "metal", "garment", etc. It is due to the special character of these texts that the signs from which a number of the Brāhmī characters were derived have not been found.

The following determinatives occur on the seal inscriptions :—

1. No. 68 is probably a sign for a place name, or gentilic. Postfixed.
2. No. 124, which see for citations.
3. No. 130, prefixed and postfixed. This I take for the word "city". It should be noted that when Nos. 130, 131 stand as prefixes, the sign 87 ends the line, wherefore No. 87 may be a gentilic ending.
4. No. 182, simple sign for "man", is a postfixed determinative showing that the name is that of a person or profession, precisely as the Sumerian pictograph for "man" (galu) *precedes* the names of professions.
5. No. 87 is clearly a *postfixed* determinative, usually followed by the inflections A or B.
6. No. 190, postfixed, see this number.
7. Nos. 193–5, postfixed determinatives for a profession.
8. No. 198, *prefixed* determinative meaning "warrior", "soldier".
9. Nos. 204–5, prefixed determinative for prince, high official.

Under Nos. 264–78 I have entered a number of signs, which appear at first sight to be numerals, but I am convinced that they are syllables, or at any rate, numeral signs used as syllables in the phonetic pronunciation of the names. For it is certain that seals, on which the engraver patiently engraved such fine designs, could not have been used *ad præsens et pro hac vice*, for the passing purpose of sealing a document with an account of a fixed quantity of some commodity. These inscriptions contain names of men and professions, as the determinatives prove. Moreover, No. 264 is probably the origin of the Brāhmī sign *B*. 34 (*ra*). And it should be noted that Sumerian signs for the numerals are often employed as phonetic syllabic elements of words.

Table of Brāhmī and Indus characters.

In the table which follows I have drawn up a list of those signs, from which some of the Brāhmī characters appear to be derived. A notable parallel to this evolution of a pictographic script into an alphabet is the Phœnician alphabet, which is undoubtedly based upon the Egyptian pictographic writing. It is true that the agreement there has the additional advantage of agreement in the *direction* of the writing; for the Egyptian writing also runs from right to left. The Brāhmī and derived characters are written left to right, whereas the Indus script undoubtedly runs from right to left. Moreover, the Kharoṣṭhī script, contemporary with the Brāhmī, was borrowed from the Aramaic, and followed its parent in the direction of the writing. Why, then, if the Brāhmī was taken from the Phœnician alphabet, did it not follow the same principle? If one can depend upon the small five letter inscription on the Eran coin, the Brāhmī script did run from right to left as its parent, the ancient pictographs of the Indus Valley.[1] The Greeks borrowed the Phœnician alphabet and altered its direction to suit their own purposes, after having retained the order (right to left) of the parent Semitic writing for a short period after the borrowing. Obviously the same circumstances may have obtained in India.

If one studies Bühler's detailed defence of a Phœnician origin of the Brāhmī script in his *On the Origin of the Indian Brāhma Alphabet*, and his table on pl. i, he will find only two letters which warrant anything like a satisfactory comparison, *Gimel* and *Teth*. Now *ga* of *B.* 11 is even more like No. 100 of the Indus characters than the Phœnician *Gimel*, and *tha*, *B.* 24, which Bühler derives from Phœnician *Teth*, is much more similar to No. 224 than Phœnician *Teth*. In fact, I am unable to see how anyone can even tentatively hold a resemblance between the Brāhmī alphabet and the Phœnician, and the positive assertion of the correctness of this theory is entirely unwarranted. Undoubtedly the great lapse of time between these seals of the Indus Valley and the age of Aśoka will be regarded as a fatal objection. But the epigraphical material may be found, and the evolution of the old pictographic writing into the late Indian alphabet will be traced. Obviously a large number of signs were discarded and only the necessary ones chosen; precisely the same procedure provided the Phœnician alphabet. If the excavations in the Indus Valley supply us with inscriptions which contain consecutive sentences and not mere proper names and titles, perhaps the key to the interpretation of this script may be discovered. Working with the present material, I suggest to Sanskrit scholars that they choose the names of a few mythical heroes and of deities, and with the few identifications here made attempt to separate the constantly recurring groups of signs and compare them with these names. The principles of ancient Indian nomenclature are only vaguely known to me. It is of course possible that this is not an Indo-Germanic language. So early a date (3200–2800 B.C.) for the existence of an Āryan civilization in India is confidently asserted to be pure legend and the dream of a national tradition.

Suggestions for decipherment.

In all this widely spread epigraphical material, ranging from the upper to the lower parts of the Indus Valley, and to ancient Sumer and Elam, there is not a single text which differs in archaic style from the others. The epigraphist has no scope for studying the evolution of the script. It represents a standardized and advanced stage even at this early period, and the existence of the accents reveals the astonishing care and knowledge of phonetic principles which would hardly be conceded to the scribes of this remote period. But the archæological evidence of the mounds in the Indus Valley is said to admit of no doubt in this matter. The seals come from strata far below the earliest Buddhist monuments. With the epigraphical

[1] Fleet, *Indian Antiquary*, xxxiii, p. 3 (Bühler's *Indian Palæography*), argues that this coin cannot be depended upon for the direction of the writing.

Archæology decisive in dating Indus script.

material alone, I should have dated this script not earlier than 800 B.C. But the Mesopotamian seals are also decisive on the problem of the chronology. Lagash and Umma disappear from history before 2000 B.C., and three of these seals were found there. If inscriptions of no other type are found in the excavations of the Indus Valley, then we must suppose that the history of this fine civilization ends with these monuments, and the vast expanse of years between that catastrophe and the invasion of the Āryans is filled with uncertain traditions. If, however, this script was preserved and finally issued into the alphabet of the Buddhistic period, it proves that the Āryans must have had intimate contact with these founders of culture in India. In any way we may look at the problem, the Āryans in India are far more ancient than history admits. Their migration across Anatolia, where traces of them are found in the inscriptions of the Hittite capital, as early as the seventeenth century, is an hypothesis entirely contradictory to the new situation revealed by these discoveries in the Indus Valley. Far more likely is it that the Āryans in India are the oldest representatives of the Indo-Germanic race.[1]

Aryans in India earlier than history admits.

[1] On this subject see *supra*, p. 112.—[ED.]

TABLE OF BRĀHMĪ CHARACTERS DERIVED FROM THE INDUS SCRIPT

Bühler Pl. II.			*Syllabic Value.*	*Number of the Indus Sign in my List.*
1			*a*	185, 193, 194, turned to right.
3		Or	*i*	269*b*.
4			*ī*	274*b*.
8			*o*	132.
9			*ka*	1 or 2.
		Pl. IV, 7.		
11			*ga*	100.
12			*ġa, gha*	96.
14			*cha*	223.
15			*ja*	66.
18			*ṭa, ṭā*	162.
23			*ta*	113.
24			*tha*	224.
28			*pa*	70.
30			*ba*	125.
32			*ma*	48.
33			*ya*	75.
34			*ra*	264.
35			*la*	87 (?).
36			*va, vu*	244.

Nota Bene.—There are many other characters of the Brāhmī script which are strikingly similar to signs of the Indus script, but to avoid misleading material for future research they are omitted.

SIGN LIST OF THE INDUS SCRIPT[1]

1 6; 179; 180 f. *ILN.* 1924; for accented forms, see No. 25.

2 267, twice as last sign. Value *Ka.*

2*b* 16.

3 233; 4; 155 f.; *RA.* xxii, 99; *CHI.* i, pl. xi, 22; 81.

4 155.

5 388 f.; 440 f.; 373 with accent B; 340; 90 f.; 388 f.; 448, preceded by No. 269. 211. Cf. Proto-Elamitic sign, No. 236.

6 388; 40; 81, preceded by No. 270; 222; 265 f.; 418; 430; 539 f.; 388; 404; 52. Accent E 478; 292.

7 580, identical with Sabæan letter for Samekh.

8 337; 18 l.; 389 l.; 49, followed by accent B; *ILN.* 1924 L; *ILN.* 1926. 463 l. Cf. No. 6.

9 *ILN.* 1924, followed by accent B.

10 *JRAS.* 1912, 700 B.

11 253; 130; 201; in all cases followed by No. 119 and termination No. 87.

12 101 l.; 342, preceded by No. 265; 237 f.

13 262 f.

14 328.

15 32; 469; 277; 198; 50. In 32; 277; and 198 followed by No. 175 and terminal sign No. 124. 540 between *fish* signs.

16 494 l.; 360; 341; 234. Delaporte, *Cat.* i, pl. xxv, No. 15 f.

17 *Dél. Per.* ii, 129 = Delaporte, *Cat.* i, pl. xxv, No. 15.

18 142.

19 329; 309 l.

161; 176.

20 497.

[1] Positions of signs in the text are indicated by f = first; l = last.

21 552, twice at end; so also 542; twice at beginning on 159; 180, twice after No. 1. On 253, line 2, after numeral III. 282 l. Stands alone 242; 121 f. These are apparently identical signs, and employed indifferently for No. 22. The first of them is identical with Sumerian *LU* (*dib*), to seize. *REC*. 456.

22 334; 101, twice at end; 16, twice at beginning as on 437; 4, alone and twice at end. 175, twice. Same form as Sumerian *GID*, *LIL*, reed mat, *REC*. 425. The most probable comparison of Nos. 21, 22, and 27 is Egyptian *sp-t*, district, determ. for province.

24 450. Cf. Proto-Elamitic sign, No. 327.

25 Accent form of No. 1. 536.

Accent form of No. 1. 39.

26 391 f. Same as 129.

27 424, twice at end. Probably same sense as No. 21. The form is identical with Sumerian *LU* (*udu*), sheep, *REC*. 454. That the sign is No. 21, is proved by comparing 424 with 437. Hence the script does not distinguish between *DIB* and *LU* as in Sumerian.

28 *ILN*. 1924, twice at beginning.

28*b* 471 l.

29 324 f.

30 387 l.; 122 f.; 554 l.; 386 l.; or read No. 30 as second sign? 355 l.

31 341.

32 2; 421.

33 306 f.; 38 f.; 337.

34 34 f.

35 550; 139.

36 444.

37 89.

38 58.

39 438.

40 18; 406.

40*b* 465, a word in itself with prefix No. 232*b* and postfix No. 87.

41 191. Cf. No. 56.

42 206.

43 65; *ILN.* 1924.

44 *ILN.* 1926.

45 438; 444.

46 346.

47 Preceded by a numeral sign, 282; 456; 47 l.; 269; 96; all have this sign after No. 178 and before terminal sign No. 68. 110; 579, with No. 48, which indicates two different signs.

ILN. 1924 f. At the end this sign is usually followed by the ending No. 68. 121 with accent B.

48 188; 412 f.; 170 f.; 199; 420; 23 f.; 107; 458; 447 f.; 139; 134. At the end this sign is usually followed by the ending No. 87; cf. 247 boustrophedon, with 107, etc. Value *ma*, *mu*.

19, 5 f.; 29, 9 f.

49 245; *CHI.* i, pl. xi, 23 f., 190.

33; 35 f. Ligature with No. 219.

50 350; 180; 447, in all cases followed by No. 68, as is its cognate No. 47, and preceded by the *fish*-sign. It is probably No. 47 with A accent.

51 33; 335.

52 319.

53 420; 215; 6.

Accented form; 405.

54 389.

55 426.

56 336; 191?; 72.

57 302; 329.

58 321.

59 52.

60 434.

61 142; 340; 77; 396. Bow and arrow? See No. 198.

62 *JRAS.* 1912, 700 C.

63 84; 14; 99; 557; 553; *ILN.* 1924; 20.

64 325.

65 343.
54 f.

66 173; 343; 336; 204 l.; 70 l.; 163 l.; 138 l.; 580; 116 l.; 110 l., twice; 227 l., twice; 138 l. This is certainly a postfix occurring after the homo determinative, as No. 87. Cf. 116, with 339, and 227. Value *ja*.

66*b* This sign occurs repeatedly in the Jemdet Nasr script, but is unknown in Sumerian. See *OECT*. vii, *Sign List*, No. 408.

67 545, twice.

68 Apparently a terminal sign, or postfixed determinative. 456 l.; 238 l.; 319 l.; 269 l.; 96 l.; 75 l.; 180 l.; 158 l.; accented form, 51.
This is the Sumerian sign for "plough", value *apin*, *pin*.

69 444 l. Probably = No. 68.

69*b* 403 at end followed by postfix 87.

70 477; 165 f.; 212 l.; 578 f.; 476 f.; 206 l. Identical with Sabæan letter Beth inverted. The sign seems to be an inflectional ending or postfix. Value *pa*. *ILN*. 1926; l., on two texts.

71 *ILN*. 1926.

72 209 f. Probably accented form of No. 70.

73 99; 544.
413; 131.

74 131; 150.

75 142; frequently followed by numbers, *ILN*. 1924. Value *ya*.

557; 425; 202; 142; 147; 170; 389; 340; 30; 544; 90; with accent B, 310.

75*b* 128. No. 75 is clearly *ya*, *B*. 33.

76 463; *JRAS*. 1912, 700 B; 3; 464 f.; 8; 38 l.

77 61.

78 *ILN*. 1926.

78*b* *ILN*. 1924.

79 420.

80 286; 336; 47; 367.

81 115; 81*b*; 81.

82 22. Compare Egyptian pictograph for "papyrus bush", Erman, *Grammatik*, 215, No. 42.

83 *ILN.* 1924; 1926. Undoubtedly a plant pictograph. See Delaporte, *Cat.* i, pl. ii, No. 8.

86 286.

87 The most frequently employed sign of the script, and certainly either an inflectional ending or determinative. 245 l.; 120 l.; 188 l.; 222 l.; 178 l.; 432 l.; 211 l.; 385 l.; 122 l.; 21 l.; 466. 325 l.; 351 l.; 339 l.; 142 l.; 369 l.; 459 l.; 296 l.; 160 l.; 253 l.; 231 l.; 226 l.; 305 l.; 81 l.; 99 l.; 557 l.; 174 l; 95 l.; *JRAS.* 1912, 700 B. 66; 553; *CHI.* i, pl. xi, 22; 412; Delaporte, *Cat.* i, pl. ii, No. 8 l. Within the text 286; 418; 139; 448; 122;262; 160; 553; 119.

As first sign, rare. Value *la*?

87*b* Accented form. 122; 347.

88 Accented form of No. 87; 234; 179; 253; 222; 442; 155; 395 f.; 99.

88*b* 329. Accented form of 88?

88*c* 490 l.

89 Accented form of No. 87; 535; 29; *CHI.* i, pl. xi, 23 f.; 247.

90 Accented form of No. 87; 469; 548; 420; 21; 461; 70.

90*b* *ILN.* 1924.

91 393.

91*b* 429. See 264*b*.

90 402. Same sign as 89?

434. Same sign as 90?

91 49; *ILN.* 1924.

233; 237.

92 494.

93 178; 142; 97; 294; 374.

94 415.

95 52. See No. 149.

96 Apparently an inflection or postfix. *RA.* xxii, 56 l.; 7 l.; 361 l.; 207 l.; 76; 537; 35; 395; 80; 159. Commonly after number-signs. It is similar to the Sabæan letter *Hâd*. Value *gha*. This sign is found scratched upon vacant spaces of inscribed tablets at Kish of the Fara period, *circa* 3200 B.C.

96*b* Accented form, 51 l.; 397.

96*c* 150; 60; 48.

96*d* 130.

97 Same sign as No. 96, or accented form of it. Cf. No. 15.

RA. xxii, 99; *ILN.* 1924, after numeral at end; 40; 580; 246 at end after numeral, as 418; 6; 449; 448; 439; 411; 220; 25.

If No. 113 (cf. 448) is a numeral, 410 belongs here.

For this sign within the text, 539, after No. 6. See No. 230. Accented form 309.

98 179; 209 l.; 203. Identical with Sabæan letter *Tau*, and Egyptian sign for "divide, count", Erman, *Grammatik*, 228, No. 7.

98*b* Accented form, 393. Cf. No. 130.

98*c* Accented form 53 l.; 136 l.; 435; 440.

13; 193. Probably same sign as No. 99; 21; 412; 413.

98*d* 398. Sign defaced.

99 100 f.; 321; here it begins a word within the text; in both places with accent.
101 l.; 370; 102 l.; 33; 87; 396 l.; 413 l.; 101 l.

Accented form; 149; 195; 100 f.; 321; 12. 106 f.; 390 f.; 149 f.; 95.

ILN. 1926.

100 355; 321; 373; 404; 283. Value *ga*.

391. accented form, 262.

101 32.

527.

102 242 f.; 155 f.

Accented form, 400 f. on line two.

103 427 l.

104 132.

105 383.

106 309.

107 47; 33 (with accent B).

108 219. Compare Egyptian pictograph *psd*, back, spine.

109 397; 357; 400.

319. Accented form of 109.

110 69.

111 357.

112 *ILN.* 1924.

113 Apparently two forms of the same sign. Cf. No. 97, and 410 with 285; 448; 538; 149. 544 f.; *RA.* xxii, 56; 90 l.; 242; 110; 211; 130; all before *fish*-sign.
265 l. After No. 266, on 425; 127. Value *ta*.

114 Accented form of 113, 349.

115 21.

116 51; *ILN.* 1924; 401; 436,

117 *JRAS.* 1912, 700. C.I.; 185 f.

Accented form 108.

118 8; 29; 69; 539; *ILN.* 1924.

Accented form 67.

Accented form 186.

119 Cf. Sumerian KUR, mountain range, *REC.* 287; 555; 197; 459, after No. 120 with which it forms a ligature in some texts; 160; 420; 201; 54; 247, before No. 47. Followed by postfix No. 124 on 197; 459; 160; or by the postfix No. 87, on 201; by accented postfix No. 89 on 420; by No. 88 on 420. Similar sign in Egyptian means "foreign land" (*h3-sh-t*), which is also the original Sumerian meaning.

130, followed by No. 87; 186; 495.

Ligature of Nos. 119 and 120; 416; 526*b*, both followed by No. 87.

120 537; 66; 123. Cf. Proto-Elamitic sign, Scheil, No. 839.

120*b* Accented forms, 367; 49; 540; 274.

121 182.

Sign defaced, 66 f. Cf. Sumerian *zu*, to know.

122 90.

471.

123 321.

124 A postfix, determinative or ending; see No. 119. At end with No. 175; 32; 41; 277; 103; 198; 534, followed by No. 266, at end with No. 178; 347; 324. At end *after* 266; 147; 170; 8; 3; 168; 345. At end with No. 176; 380; 583 f.; 286 l.; 225 l.
Within the text, *ILN.* 1926. See No. 226.

124*b* 30. Within the text after No. 175, *ILN.* 1926 ( ).

124*c* 556 after No. 175.

125 *ILN.* 1924 *f.* 111. Same sign as No. 219. Resembles Sabæan letter *Fâ*. Identical with Sumerian sign for DUG "good", *REC.* 206; Proto-Elamitic sign, 720 + 865. Value *ba.*

126 Same sign as No. 232? 305; 94 f.; 215 f.; 67. The Sumerian ideograph for "heart", *REC.* 255, is obviously not this sign; see the early forms, *ibid.* 78 f.; 139 f. on line two.

126*b* Accented form 494 f.; 340 f.; 433 f.; 246 f.; 115 f.; 326 f.; 369 f.; 97 f.; 181 f.; 127 f.; 57 f.; 80 f.; 476 l.; 477 l. Within the text, 426; 97. On 386 this sign stands at the beginning of the name of a profession, or N. Pr. 551 f.

127 183. Cf. the Sumerian sign Šargadu, *REC.* 215.

127*b* 329.

128 362 l. Ligature of 125 and 96. Note that 96 is also an ending.

128*b* 99, independent sign standing beneath the text as No. 217.

129 *ILN.* 1926 f. Same as No. 26.

130 Accented form of 125, 360 f. Cf. No. 99, and Proto-Elamitic sign, No. 726.

130*a* 227; accented form of No. 125. Cf. No. 98.

130*b* Same sign as No. 234. 285 f. before No. 113; 432; 338 l. This sign probably means "city" as does the corresponding Egyptian determ. for city; Erman, *Grammatik*, 217, No. 1. It is totally different from the Sumerian pictograph for "city", *REC.* 358.

131 118 f.

131*b* Accented form, 416 f. See No. 234.

131*c* Accented form, 387 f.

132 — 195 l. Value *o*, *u*.

133 — 370; 267.

549; 13; 27; 87; all after the *hare*-sign, No. 168, as also 370. 195 l.

134 — 107 f.; 494.

135 — 195 f.; 475 f.; 279 f.; 27; 295; 28; 20; 426; 23.

136 — 306.

137 — *ILN.* 1924 l.

138 — Delaporte, *Cat.* i, pl. ii, T. 24 L. See No. 87.

139 — Delaporte, *Cat.* i, pl. ii, T. 24. Cf. No. 83.

140 — Delaporte, *Cat.* i, pl. ii, T. 24. The sign is not very clear on the impression, and its form is to be restored from 309.

141 — *RA.* xxii, 56 f. It is possible that the Brāhmī character *sa*, B. 39, is derived from this or No. 142.

142 — *RA.* xii, 56; Delaporte, *Cat.* i, pl. ii, T. 24. Cf. the Egyptian sign determ. for "to bind", *if.*

ILN. 1924.

143 — *RA.* xxii, 56.

144 — 214 f.

145 — 540 f.; 464; 226.

340.

426 f.

Accented form 474.

146 — *ASR.* 1923–4, pl. xix, 15.

147 — 574, in two places.

148 — 172 f.

149 — 12; 58; 139; 265; 211 f. See No. 95.

315; 395; 52.

150 — *ILN*. 1924 f.; followed by No. 68.

150*b* — 446. Partly obliterated. Probably to be restored as No. 151.

151 — 464; 446 f.; *CHI*. i, pl. xi, 22; cf. No. 212.

152 — *ILN*. 1924.

153 — 36; at end followed by suffix 87; 188; 460; 311. 11; 72 before and after *homo*-sign 473 f. and l. 472 f.; 471; l. on A after No. 264. 108 f.; 185. Identical with Sabæan letter *Rā*. It has also the same form as No. 162 with opposite position. No. 162 is also identical with the Sumerian sign *ŠUŠ*, *REC*. 257, which indicates the fraction ⅙ and the Proto-Elamitic sign, Scheil, No. 127, 3, which indicates ⅙ there. 257 l. on line 3.

153*b* — 41 f.; 160 f.

153*c* — 321 f.

444 f., after prefix 233; also 20.

321. Before *fish*-sign.

153*d* — 403. Before *fish*-sign. 212 f.

154 — At end followed by postfix 87; 23; 499; 540, and cf. No. 265 also in same position which seems to indicate an identity of No. 153 with 264 and 154 with 265. 461 l.; 221 f. after prefix 233*b*, and compare 114, which again indicates 154 = 265. 421 in text; 397 after? But 540 has 265–154–87, which excludes the identification suggested; see also 42.

154*b* — 21 f.

155 — 72, after No. 155.

156 — At end followed by suffix No. 87; 120; 351; 224; 5, which seems to prove the identity of Nos. 156 and 154.
439 f., followed by No. 87, 11 followed by No. 153.

156*b* — Delaporte, *Cat*. i, pl. xxv, No. 15 f.

156*c* — 373.

157 — 43; 434 f.

157*b* — 289.

158 — 42; followed by postfix No. 87. Certainly *two* signs, Nos. 156 + 265.

159 — 74. This is hardly an accented form of No. 153. See No. 269*b* and 274*b*.

160 — 186 f.; 457 f.; 302 f.; 161; 100. Cf. No. 161 pictograph of a shield?

160*b* — Accented form, 361 f.; 29 f.; 160 f.; 469 f. 24 f.; 469 f.; 24 f.

161 — 225 f. Cf. No. 160. 457.

162 — 16 l.; 403. But used with No. 153 to enclose signs. See Nos. 167, 171, 201, 175*c*. Accented form, 296. Value *ṭa*. See remarks under No. 153.

163 — 122.

164 — 194, after *hare*-sign, No. 168.

165 — 8 f.

166 — 431.

167 — 6.

— 77; 306.

168 — 262; 370; 27, followed by No. 133; 194 f. This seal has hare, fowl, and a bird with deployed wings. Pictograph of a hare. For some reasons these signs have been turned 90 degrees to the left.

168*b* — 115; 49.

168*c* — 549; 67. Cf. 370 with 549, where this sign and No. 168 are followed on both seals by Nos. 133–99–87.

168*d* — No. 168*d* on 87 is apparently identical with No. 168*g*.

168*e* — 101; 12, followed by Nos. 133–99–87; 179. Compare 12 with 13, same text?

168*f* — 13, followed by Nos. 133–99–87.

168*g* — 21.

169 — 237. The bird signs Nos. 169–72 indicate various kinds of birds as do the corresponding Egyptian pictographs.

170 — 228.

170*b* — 36; 338, twice at beginning.

171 — 219 f.

172 — Bird with deployed wings. 194.

173 — 207 followed by No. 267 and postfix No. 96.

174 — *ASR*. 1923–4, pl. xix, 15. This sign clearly suggests the emphatic or *gunu* form of the Sumerian sign for bird. For the bird sign in Sumerian, see Thureau-Dangin, *REC*. 33, and especially *Revue d'Assyriologie*, vi, 142, *Rev.* ii, 3, and *Rev.* i, 1, Sign *MUD* "bird with egg" according to Genouillac, *RA*. vi, 160; almost identical with this sign.

174*b* — *Dél. Per.* ii, 129.

175 — Probably intended for a *fish*, but the resemblance to the Sumerian sign *HA* is not very close. 41; 277, at end with postfix No. 124; also 32; 198, often combined with No. 178; 175–178 on 47; 324 (+ No. 124); 14; 79, Nos. 176–175 only on 455.
Nos. 178–175 on 53; 534; 88; 313.

(373) — Not combined with a *fish*-sign, *ILN*. 1924; 1926; *JRAS*. 1912, 700 A.
81; 110; 188; 32; 211; 142; 130; 120; 104; 365; 254; 23; 261; 19; 87, before *hare*-sign; 75 f.; before No. 212.

175*b* — Accented form 177 l.

175*c* — 148.

175*d* — Accented form, *JRAS*. 1925, 697.

175*e* — Accented form, 211.

176 — 95; 170; 380, after No. 177; 455, before No. 175; *CHI*. i, pl. xi, 22 f. After No. 177; 380; 350.

176*b* — 156, after No. 175. Accented form.

177 — Accented form of No. 175. 540; 40 f. Often with No. 178 in the order 177–178; 400; 544; 21; 404; 379; 87; 109; with No. 175 in order 177–175; 350; 321; 470; *ILN*. 1924 f. with No. 176 q.v. Not with a *fish*-sign; 420; 349; 418 f.; 269; 202; 580; 283; *JRAS*. 1912, 700 C.

177*b* — Accented form 425 f.; 48 l.; 66; 403; 316, only sign on this seal. 156, after No. 175; 147.

178 — Probably also a *fish*-sign. With No. 175 in order 178–175; 534; 79, etc. See No. 175. With No. 177 in order 177–178; 400, etc. See No. 177.
Not with another *fish*-sign; 198; 347; 557; 351.

178*b* — Accented form, 535 l.; 36.

179 — Not same sign as No. 176. 370 f.; 308, after No. 176. Cf. 370 with 549, same text?

179*b* — 75 f.

180 — 415 f.

181 — 4. The unaccented form is found on a seal in *ILN*. 1924 L.

182 — 395.

182 — The *homo*-sign. A large number of variant forms occur and there is not complete consistency in regard to its direction. It occurs (1) *en face*, (2) facing *right*, (3) facing *left*. They are given in this order. This is the only pictograph which does not consistently face to the left, as do the numerous *homo* pictographs of Egyptian. The Sumerian pictograph for *man* faces right naturally, but its early form is not known, *REC*., 289. It is clear that these forms of the *homo*-sign express some special aspect of human activity, as do the Egyptian forms. *En face* 336 l., after No. 87; 386, after No. 87, followed by No. 30; 225, followed by 124. 214 l., after No. 87; so also 115; 536; 295; 109. This sign is undoubtedly a postfixed determinative indicating that these are

either N.Prs. or names of professions. In 218; 117; 553; 334; 117, it forms part of the N.Pr.

183 116, followed by No. 87 and after No. 204. Cf. 339.
50 at end followed by No. 87.
325 at end followed by No. 87.
339 at end followed by No. 87 and after No. 204. 209 (walking to left (?)), followed by No. 87, end of line 1; at end followed by No. 87, 99.

184 Man supporting two clubs. 419 l.; 426; 28 end followed by No. 87 l.

401, followed by No. 87 L.; 11, within text at end of a N.Pr. followed by name of a profession.

185 *Dél. Per.* ii, 129 f.; after No. 278*b*. The Brāhmī character for *a*, B. 1, is probably derived from this sign.

186 *JRAS.* 1912, 700 C. f.

187 Man holding branch or implement in left hand, 50. On No. 188 clearly facing right. Obviously No. 188 is only a variant. Cf. 50 with 37, both after the same two signs.

188 Man holding an implement, 37.

189 410 f. Man striking? Cf. Egyptian pictograph *ḥw*, "to strike," but not precisely the same postures.

190 182 l. Man under sun-shade? In any case a determinative after a name.

191 189 l. Determ.

192 16, probably not a *homo*-sign.

193 Man carrying yoke with baskets, 121 l.; 557 *b*; at end after No. 264. 218 l.; 117 l.; at end after No. 96; 315. Also on 43 l.; 360 l.; 79 l. Clearly a determinative of a profession, "builder, carrier," etc., at end after No. 113; 127. See No. 185.

194 Probably same sign as No. 193. 312 l. *Dél. Per.* ii, 129 l.

195 Sign partially defaced. 163 at end followed by No. 66.

195*b* At end after No. 264; 30; 287. At end after No. 265; 205. *RA.* xxii, 99 l. 228 l.; 475 l.; 178 an ideograph in the N.Pr. This is obviously a determinative and a *homo*-sign, but the head is invariably omitted. Possibly a sign for a sun-god, i.e. Janus headed, as in Sumerian glyptique; cf. *Babyloniaca*, IX, p, 78, No. 128.

436 l.; a comparison of 436 with 401 suggests a sense similar to No. 184.

196 Man with sceptre, like Egyptian pictograph *śr*, "prince," "great one," "great." Used as a determ. in 78 at end followed by postfix No. 87.
As a word or syllable meaning "great"? 118; 424; and duplicate 437. The N.Pr. on 437 and 424 has some meaning like "Master of the district". 325 f.

196*b* Apparently "man holding an implement"; 347 f.

197 321, line 2. Faces left.

198 Man with bow and arrow. In Egyptian this figure is kneeling and in act of shooting, there determ. for "foe", and as noun *hftj*, "foe." 12 f. on line 2, 70 followed by No. 66. 406, probably beginning of a title. 15; 400, line 3, ideograph in N.Pra. 142 f.; 305 f.; 92 f.; 69 f.; 142 f.; within text 190; 60. When this sign is a determ., it usually stands at the *beginning*. 403 f.

199 Man with boomerang. 43 f.

199*b* 42 f.

200 165 f. A ligature of 70 + 182?

201 575 f. On this seal the two signs, 201*b* followed by No. 175, seem to be enclosed in the parenthesis sign.

201*b*

202 449 f. Compare the Egyptian pictograph for "pass over, go beyond", Erman, *Grammatik*, p. 208, No. 100.

203 307 l. The inscription is not clear and this sign is not entirely certain.

204 348 f.; 301 f., followed by No. 268 and postfix No. 96, 331 at end followed by No. 87.

101 f.; 373 f.; 339, after No. 266 f., and before No. 184 f. and No. 87 l. Same text on 116, but No. 183 in third place. 266 after No. 268.

151 f.

205 555 f. Same sign as No. 204, facing left.

205*b* 482, only sign on the seal.

206 A plant pictograph, 537.

207 Palm leaf, 42. The Egyptian sign *im*3, determ. for "tree", is similar.

208 473.

209 473.

210 191. Probably sign No. 204.

211 200.

212 75, followed by postfix No. 68.

213 161 at end followed by postfix No. 87.

214 126 at end followed by postfix No. 87, 340.

215 *RA*. xxii, 99 f.

216 — 320 f. at end followed by postfix No. 87.

217 — Defaced sign on 16, standing alone beneath the text.

218 — 536.

219 — 188. On 325 an independent sign beneath the text; 278 f. on line 2, boustrophedon.

219*b* — 253 f.
398 f.

220 — 235 f.; 369; *JRAS*. 1912, 700 A; 536; 215; *ILN*. 1926 (in all places followed by No. 265). 552 preceded by No. 265. 315 f.; 99; 257.

220*b* — Accented form, 321 l.; 12 l. on line 2; 397 l.

221 — 80 at end followed by postfix No. 96.

222 — 409; 467, at end, followed by No. 97 (96).

223 — 325, text A; followed by Nos. 268 and 188 (187), 50 *l*.; 37; 303 followed by No. 268. Value *cha*.

224 — 221 l.; 421. Cf. the Sumerian sign TEMEN, *REC*. 217, value *te*. 478; 236 f.

400, line 3. Value *tha*.

225 — 349 f.

226 — No. 124 inserted in 219. 292 l., and note that No. 124 usually comes l.

227 — 142; 105; *ILN*. 1924, at end followed by No. 137.

228 — 389; 35.

229 — 28. 77, same sign?

230 — No. 96 inserted in No. 219. 217 f.; 173 f.; 224 f.; 49 f.; 45 f.; 540; 126. This sign is here either in the first position or it immediately follows the initial sign. 95 at end followed by postfix No. 87.

230*b* — 161 f.; 430 after initial sign; 164; 6; 66; 467 f.; 445 l.

204 twice before postfix No. 66.

231 — 552; 84.

232 — One of the most frequently recurring signs; and usually at the beginning. See No. 126. *ILN*. 1924 f., followed by No. 118, 245 at end followed by No. 87. 351 f.; 36 l. Stands alone on 486.

Apparently variant of No. 232. 147 f.

232*b* — *ILN*. 1926 f., followed by No. 178; 32 f.; 372 f.; 424 f.; 537 f.; 232 f.; 96 f.; 22 f. 553 within text. 19 f.; 554 f.; 88 f.; 317; 393 f.

334 f.

232c 131 f.; 59 f.

233 547 l.; 110 f.; followed by No. 47, and at end followed by No. 66b. 186 at end followed by No. 96. *ILN*. 1924, at end followed by No. 66b. 490 twice f.; 406. *ILN*. 1926 l., 266; 444 f.

233b Accented form. 221 f.; 438 f.; 61 f.; 88 f.

233c Accented form. 79 f.; 76 f.; 178 f.; 10 f.; 400 f.; 105 f.; 344 f.; 327 f.; 104 f.; 148 f.; 468 f.; 498 f.; 407 f.; 126 f.

233d Accented form. 134 f.; 335 f.; 192 f.; 543 f.; 345 f.; 189 f.

233e 478. But see 264c.

234 445 f.; 59 f. See No. 130.

235 83 f. twice; 15 l.; 47 f.; 319 f.

236 Sign defaced, 3.

237 52 f.; 302; 121; 20 f.; 175; 329; 336.

238 330 f.

239 203 l.

240 174 f.

241 276; 421 l.

544.

242 209 l.

243 252 f.

244 553; 67 f.; 55. Value *va*.

245 574.

246 182 f.

247 46 f. Probably a musical instrument.

248 Delaporte, *Cat.* ii, pl. xxv, No. 15.

249 253.

250 Goose in circle. *ILN*. 1924; stands between two vegetation signs, No. 91 (on either side).

251 Sign defaced. 379, with *fish*-sign. To be compared with the Egyptian pictograph *ḫpr*, "beetle," and with the Sumerian sign GIR, "scorpion," *REC.*, No. 4.

252 252 l.

253 52.

254 548 l.

255 175 l.

256 302.

257 325, line 2.

258 21.

259 391.

260 253 f. on L. 2, boustrophedon. Similar to the Egyptian determ. for worm, Erman, *Grammatik*, 213, No. 22.

261 102 f. Undoubtedly sign for water, and similar to the Egyptian sign, Erman, *Grammatik*, 217, No. 55. The Sabæan letter Mêm is of the same pictographic design, and so is the Phœnician. In actual form the Sumerian pictograph, A, "water," *REC.*, 470, resembles the Indus script more than any known cognate sign.

262 60 f.

263 151.

263*b* 329.

264 336, after No. 56, before No. 237. 202 f. 117 twice as 2–No. 182–5. 218 after No. 182; 286 between Nos. 88–237; 30, before No. 195, after No. 124*b*; 318, before No. 182. 106 before No. 87; 97 f.; before 126*b*; 30; 287, at end followed by determ. No. 195. 336 before No. 237. 202 f.; 28 f.; 287 f.; 168 f.; 187 f.; 141 f.; 190 f.; 429; 286. 450 l. 189 f.; after prefix No. 233*d*. Value *ra*.

264*b* Apparently two signs, 113.

264*c* Accented form; 267 f. What is , 478?

Accented form; 66.

Probably two signs, 441.

Apparently two signs, 113.

264*d* 429 Ligature.

264*e* 389, sign defaced.

265 48 after No. 96*c*; 218 f.; before No. 182; 120 f., before No. 175; 278 l. after No. 96; 552 f.; 81 f. and between 81*b*–175; 120 f.; 369; 536 before No. 87. 23; 549, before No. 175. 215; 77; 42; 541; 146; 263 at end before No. 87. 222 after No. 87*b*. 357 l.; 14 f.; after prefix No. 232*b*, as on 82, both before *fish*-sign; see also same series in the text, 324; and 468 f.; 114; 79 where prefix is No. 233*c*. 342 f. 48; 47 (second and fifth signs); 8; and in text apparently beginning of a second word. 406. 205 f. and third signs. 65 f.; 266 l. On 551 f. after prefix 126*b* before *fish*-sign, same sense as 14; 82; 432 after vowel sign *i*, No. 269*b*.

266 429 after No. 75, before No. 264*b*; 425 before No. 113; 253 l.; 326 l.; 147; 65; 94; 105; 68; 3; 168; 345; 170 at end followed by postfix No. 124; and 30 followed by 124*b*. 77 f.; 414; 429; 456; 431. 400 f. on line 3. 541; 104. The combination of Nos. 266–124 occurs on 251 with postfix No. 66. It will be seen from these citations that No. 265 is usually followed by the postfix No. 87, and No. 266 by the postfix No. 124 at the end of a word.

266*b* Doubled sign; 539; 54.

266*c* No. 265+266, two signs, 191.

267 574 f. and l. on both A and B. 126 followed by No. 96. At end with No. 96, 395. 321 f. on line 2.

268 325 f., before No. 223. 6, 16; 13, 2; 50 after No. 223, in all places before No. 188 or 187. 54, etc. See 266*b*.

269 Accent on No. 109.

269*b* Accent? on No. 241. But on 448 f.; 432 f.; 366 f.; 257 f.; Delaporte, *Cat.* i, pl. ii, T. 24; this is clearly a sign. See No. 159.

270 41; 372; 361 at end followed by No. 96; 339 f.; 365 f.; 411; 220; 91 with No. 96. 116 f.; 282 f.

271 207 at end with No. 96; also 449; 246; 229; 418; 159; 143; 441; 31; 346; 133. 453. 321 l. on line 2. 471. C., 19.

272 301 between *home*-sign and No. 96. 460 f. 92. 51 f. 6. 311, with No. 96; 402; 418.

273 66 between No. 120 and No. 87.

274 253 f. See No. 162.
123 between No. 120 and No. 87; also 466.

274*b* 74 at end, followed by No. 87; 296 f.; 130; 400, line two; 131; 39. See accents F and G.

275 439, followed by No. 97; also 35; 227; 243; 249. 314 before *fish*-sign.

276 273 f. followed by No. 265; 548 f.; followed by No. 87.

277 — 548 f.; 156; 414, at end followed by No. 87. 3; 79; 404. 470 f. 105 f. after prefix No. 233*c*. 415.

278 — 211; 442; 553. 146 f.; after prefix No. 232*b*, also 344. 25 with No. 96. 435 f.; after prefix No. 48.

278*b* — Delaporte, *Cat.* i, pl. xxv, No. 15; 478 l.

279 — This is a hapax and there is no similar combination, 535. Perhaps a prefix like No. 233*d* + No. 264 is to be understood. Cf. 189.

280 — 580, *sic!* Cf. No. 66.

281 — 382.

282 — 426.

283 — 144 f.

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Postcript

Since the preceding study of the Indus Valley script was made over a year ago I have, in the interval, completed my study of over 200 tablets in the most archaic Sumerian script, excavated at Jemdet Nasr, 17 miles N.E. of Kish, in 1926. These tablets supply an almost complete corpus of the most archaic Sumerian signs, and, as they were found with a mass of painted pottery akin to the painted ware of the Indus Valley, which accompanied the Indus Valley seals, it is obviously necessary to comment upon the relation between the two scripts. In the following study I shall refer to the new early Sumerian sign list based upon the Jemdet Nasr tablets as PI = Pictographic Inscriptions from Jemdet Nasr, *Oxford Editions of Cuneiform Texts*, vol. vii, Herbert Weld Collection of the Ashmolean Museum. In the Jemdet Nasr tablets we possess the earliest large collection of tablets made by the people who invented the originally pictographic script used by the Sumerian people.

As to the racial character of the people who invented the Sumerian script, as it appears in its earliest known stage of development on the Jemdet Nasr tablets, and on a certain few archaic stone tablets of the same period from Nippur, Kish, and other unknown sites, I express the opinion that they are Sumerian. In any case the language of these texts is Sumerian, although the grammar is in such primitive state that the verbal system of Sumerian had not yet been attained. The signs have the same sense as in the later Sumerian texts. A few god names, which are Sumerian, such as the great trinity *An*, heaven god, *Enlil*, earth god, *Enki*, water god, and *lamma*, the divine protecting genius, appear in these texts, but the determinative for god and in fact the entire system of determinatives of the later Sumerian are almost entirely absent. A good many new signs, unknown in later Sumerian, are present in this archaic script, and some of them are identical with signs of the Indus Valley script.

There is, then, definite linguistic evidence that the Jemdet Nasr and contemporary civilization of the Mesopotamian Valley at the time when the painted pottery was made, was Sumerian. On the Zoological side there is from the Jemdet Nasr texts the definite conclusion that the buffalo, *Bos bubalis* (No. 128 of PI.), is the well-known prehistoric animal (represented by the Sumerian pictograph *DUN*) which disappeared in Mesopotamia about 2600 B.C. The archaic period represented by the painted pottery and tablets comes down to about 3500 B.C., and goes back to an indefinite period, certainly as early as 4000 B.C. There is also the astonishing fact revealed by the Jemdet Nasr tablets that the *horse* was in use then; for the ideogram for *horse* (*ansu-kur*) "ass of the mountain" occurs as a pictograph here. Of the important mammals occurring on the Jemdet Nasr tablets, viz. the ox (*Bos primigenius*), the buffalo, and the horse, one certainly occurs on the Indus Valley seals, the *Bos primigenius* (VS 3503, etc.); the bison (VS 3026, HR 2657, DK 2137, HR 4348 *et passim*) is also characteristic of early Sumerian art (Hilzheimer, *Die Wilrinder im alten Mesopotamien*, 10–13).[1] As to the animal most characteristic of the Indus Valley seals, with thin long nose, long *forward* protruding horns, and smooth body, I suggest that the forward protruding horn is stylistic, and that this is the buffalo, so characteristic of early Sumerian art, and the *DUN*, so common in the domestic life of the Sumerian people from the most archaic period until this animal disappears about the time of Sargon of Accad.[2]

[1] I am sorry to dissent from Professor Langdon regarding these identifications, but seal VS 3503 (= No. 312) appears to me clearly to depict the Indian bison (*Bos gaurus*), as do all the seals from No. 308 to No. 326. Similarly, the seals VS 3026 (= No. 333), HR 2657 (= No. 335), DK 2137 (= No. 339), and HR 4348 (= No 329) seem to me just as clearly to portray the Indian humped bull (*Bos indicus*). So far as I am aware, the *bos primigenius* is not represented on the seals. See p. 70 *supra*.—[Ed.]

[2] The buffalo (*bos bubalis*) is illustrated in seals 304–6 and appears quite distinct from the unicorn commonly figured on the seals.—[Ed.]

It is, however, on the epigraphical side that I wish to emphasize more definite connection between the most archaic Sumerian script and the Indus Valley script than I was disposed to admit in my preceding study. The entire method of writing Sumerian pictographs in the upright and natural position exists on extremely few monuments which have survived, notably on the earliest of all known survivals of writing, the pictographic stone tablet of Kish (Langdon, *Excavations at Kish*, vol. i, pl. xxxi). The great mass of archaic Sumerian texts already represent the signs turned 90 degrees to the left. This was done to facilitate rapid writing from left to right, whereas the original pictographs were written from right to left in perpendicular position. In the new system every sign lies on its left side. Now the Indus Valley system, which still retains many traces of its pictographic origin, remained true to its original principle; the writing still runs from right to left and the signs still retain their upright position. Obviously any comparison of the Sumerian signs with the Indus Valley signs must be made after turning each Sumerian sign 90 degrees to the right, thus bringing it into its original upright position. By utilizing the new material in PI., which provides far more ancient and extensive material than in *REC.*, employed by the author in his preceding study, the following list of signs can be compared :—

1. No. 15 = PI. 84, *gal*, "large," "great."
   No. 16 is, therefore, *gal-gal*, plural of No. 15.
2. No. 2 = PI. 35, *maš*, "half."
3. No. 8 = PI. 6, *na, za, ia*, "stone," "jewel."
4. No. 33 = PI. 246, *gug*, "beans" or "peas".
5. No. 29, cf. PI. 360, .
6. No. 37 = PI. 293, , disappeared in later Sumerian.
7. No. 63 = Sum. *ug*, "to die," "dead."
8. No. 66 = PI. 408, so in secondary position. Very common in J–N, but disappeared in later Sumerian. Value unknown.
9. No. 68 = PI. 125, picture of a plough, values *apin, pin, engar, uru*.
10. No. 70 = PI. 44, , disappeared in later Sumerian.
11. No. 71. This sign is so nearly identical with the form of *TUM* in its secondary position, PI. 338, values *ib, tum*, that the forms may be identical.
12. No. 83; cf. PI. 144, possibly the pictograph of the date palm, values *sag, gišimmar*.
13. No. 98 = PI. 12, , disappeared in later Sumerian.
14. No. 100 = PI. 270, , value *lal*, "lacking," "missing," "to weigh," "bind."
15. No. 113, perhaps Sum. *bad*, "open."
16. No. 264 = PI. 1, values *aš, rum, dil*. Cf. value *ra*, suggested from Brāhmī.
16. No. 265 = PI. 41, *tab*, "double," "pair."
17. No. 266 = PI. 57, *eš*, three. Used as a syllable, not as numeral, in Indus script and usually so in PI.

18. No. 276 = Pl. 64,

19. Nos. 277–8, cf. Pl. 75–6, and .

20. No. 283 = Pl. 192, *ḫu, mulen, pag, dar.*

Among the identifications above, (2) has the value *mas*, but the Brāhmī value *ka*; (14) value *lal*, *la*, but Brāhmī *ga*. If the two main hypotheses be assumed as true, (1) the identity of the Sumerian and Indus signs, (2) the derivation of the Brāhmī characters from the Indus signs, then it must follow that the Āryan Sanskritists gave values derived from their own language to these characters. In other words they knew the ideographic meanings, translated them into Sanskrit, and derived the syllabic values from the Sanskrit words.

The connection of this script with Sumerian is favoured by the many similar or identical signs noted in the sign list and in the new comparisons above. There is also the extraordinary fact that both Sumerian and Indus Valley scripts freely employ numerical ideographs as syllables and that the two both read from right to left.

OXFORD,
13th July, 1928.

CHAPTER XXIV

HOUSEHOLD OBJECTS, TOOLS, AND IMPLEMENTS

THE objects described in this chapter have all been found in houses and buildings at Mohenjo-daro. Those whose uses are obvious come at the beginning of the chapter and those of uncertain or unknown use at the end. In each section stone objects are described first, followed by objects of pottery and other materials.

Querns (Pl. CXXX, 16 and 17 ; Pl. CLVII, 54)

Proof of Agriculture.

Judging from the very large number of saddle-querns found, the only form of quern apparently used at Mohenjo-daro,[1] agriculture must have been in a flourishing state at that place. As far as we know at present, wheat was the principal corn that was grown. Samples of this cereal have been found in several parts of the site, badly carbonized, but otherwise sufficiently well preserved for the species to be identified. No samples of barley or other forms of grain have yet been found, but it is quite possible that barley or rice was grown as a food for the lower classes.

Materials.

The better made querns are almost invariably made of basalt ; in one case grey granite was used. They are all very much worn, the depression in some of them being as much as 5 inches deep, so that only the end of a stone muller could have been used. The grain appears, therefore, to have been pounded rather than rubbed.

Dimensions.

The average size of these querns is 21 by 9 inches. The mullers, one of which is shown lying on its quern (Pl. CXXX, 16), are usually natural pebbles averaging 11 inches long by 4 inches in diameter. Only the ends of these mullers seem to have been used, to judge from the bruising of the stone. Sometimes blocks of red sandstone or quartzite were used as querns ; and from the frequent irregularity of their bases one must suppose that they were intended to be partly sunk in the floor of the house or courtyard. The upper surface of a new quern was roughly dressed flat and then by much use was worn into a deep groove.

None of the querns can be dated to any particular period by either their shape or the stone of which they are made, and they are found at all levels.[2]

[1] The circular revolving quern does not occur in either Mesopotamia or Egypt until late times. It is known in India from about the second century B.C.

[2] Similar saddle-querns are known in both Egypt and Mesopotamia and at Anau, where they date from very early times. They are always worn into a deep concave shape by the rolling of a long stone to and fro. They are also common in the historic period in India.

Descriptions. No. 16 in Pl. CXXX (VS 1925) is really a large natural pebble of basalt, 17·5 inches long by 9·5 inches wide by 4 inches high, whose centre has been very much worn down. Six feet below surface. House XXV, VS Area.

No. 17 in the same plate (VS 790), which measures 19 inches long by 11·5 inches wide by 6 inches high at the ends, is a very roughly dressed pebble of sandstone. Two feet below surface in House XVIII, VS Area.

No. 54 in Pl. CLVII (HR 742), which is of basalt, is somewhat better made. It has roughly fashioned feet for use on a brick pavement. Five feet below surface. Southern end of Chamber 3, House II, Block 2, HR Area.

Mode of manufacture. Pumpelly's suggestion that the similar querns found at Anau were made by cracking apart a small quartzite boulder and rubbing together the two new surfaces till they became flat seems likely to be correct.[1] Most of the querns found at Mohenjo-daro have curved bases, which were roughly dressed. It was probably found that the natural surface of the two halves of a boulder allowed of too much rocking and that it was necessary, in consequence, to roughen the surfaces.

Palettes (Pl. CXXX, 11 and 31 ; Pl. CXXXI, 39 and 40 ; Pl. CXXXIII, 4–6)

Stone palettes of good workmanship are not often found at Mohenjo-daro. Four examples, in slate, of especial interest are described below :—

Descriptions. No. 11 in Pl. CXXX (VS 416) measures 12·3 by 8·8 by 0·8 inches. It is beautifully made and one side shows evidence of much rubbing, but no trace of colour is left. Level, 3 feet below surface. House XIX, Block 3, VS Area.

No. 31 in the same Plate (VS 1853) measures 11·5 inches long by 4·3 inches at its widest part by 1·2 inches thick. At first sight it appears to be a stone adze, but it has no edge. It is slightly irregular in shape, especially at the rounded end, and neither side shows any trace of rubbing. Level, 4 feet below surface. House XXV, VS Area.

A fragment of stone (VS 2894) found in the same area must have been part of a palette very similar to No. 31. It measures 4·85 inches wide and 1·45 inches thick ; the length cannot be determined owing to breakage. Level, 3 feet below surface. Room 65, House XVII, Block 2, VS Area.

Another palette found in the SD Area (SD 2577), made of dark grey slate, measures 4·7 by 4·25 by ·95 inches. Both faces show signs of very considerable use, the centres of each being very much worn down on both sides. This palette seems originally to have been considerably longer, for a fracture at one edge has been partially rubbed down. There is a trace of red pigment on one side. It was found in Chamber 18 of the Great Bath at a level of 7 feet below the surface.

Material and use. These palettes are all made of a very dark coloured slate, with the exception of SD 2577, which is somewhat lighter in colour. They were probably used for rubbing down hæmatite and other colours for cosmetics or for painting pottery. We have not found the mullers that were used with these palettes, but these also were probably made of slate.

Use of flat pebbles. Ordinary flat pebbles, as shown in Pl. CXXXI, 39 and 40, were also used as palettes, and even neatly shaped rectangular pieces of sandstone (Pl. CXXXIII, 4–6). Some of the latter show evidence of much wear, and as the majority were found in houses they were probably used in the preparation of eye-paint and other pigments.

[1] *Explorations in Turkestan*, vol. ii, p. 477.

Flint Implements (Pl. CXXXI, 1–19)

Flakes and cores.

The flint implements found at Mohenjo-daro are of the simplest description, most of them being long flakes that were probably used for cutting up meat and for other household purposes. Both the flakes and the cores from which they were struck are found in nearly all the houses. Indeed, it is probable that flakes were struck by the servants of the household whenever an implement of this kind was required.

No short flakes.

No specimens of the short flakes, both notched and unnotched, that are so common in the early periods of Babylonia, have been found at Mohenjo-daro, nor any traces of pottery sickles; and it is evident that flint was not used in the manufacture of sickles as it was in both Sumer and Elam. Nor are the well-finished lanceolate and leaf-shaped flint arrow-heads, that are such a feature of the earliest periods of Sumer and Elam, found at Mohenjo-daro, though they are known in other parts of India. We do not yet know what lies hidden in the Early strata of Mohenjo-daro, but from the Intermediate and Late strata it is evident that in those periods metal working was in an advanced state and flint implements were no longer in great demand. The art of working flint had, however, by no means languished, for we find this and allied materials in almost universal use for the manufacture of beads and weights. The latter, especially, are beautifully made, being first flaked into shape and then ground.

The form of flint most used at Mohenjo-daro was a brownish-grey chert which was often mottled. Neither flakes nor cores show any trace of patina.

Polishers.

Besides being used for striking flakes from when required, the flint cores found had in some cases been used as rubbers, e.g., No. 13 in Pl. CXXXI (DK 774), whose edges near its point have been rubbed down and slightly polished. This core is 4·15 inches long and comes from Space 7, Block 1, Section C, DK Area, 4 feet below the surface. The tip of No. 14 (E 80), which is 4 inches long, has been rubbed down to a rough edge and may have been used as a burnisher. This last was unearthed in the street between Houses I and II, Trench E, M, DK Area. Level, 4 feet below surface.

The sides of two flint flakes (HR 1821 and DK 2361) had evidently been used as polishers and in consequence were greatly worn down.

Three flint implements have been found which may have been used for agricultural purposes; they seem too big to have been used as weapons of offence or defence and are too unfinished to be any kind of tool. They are rectangular in shape and very roughly flaked. The cutting edge has two sloping sides and the long sides of the implement are square cut. Nos. 17 and 19 have slightly convex faces, but those of No. 18 are plane, or practically so. In conception these implements are not unlike the shoe-last celts of the Danubian culture, except that they are not ground and lack the plano-convex appearance of the Danubian specimens.[1] In fact the examples found at Mohenjo-daro appear never to have been used; they give the impression of being unfinished, and it may have been intended to grind their surfaces.

Descriptions.

No. 17 in Pl. CXXXI (VS 1218) is 10·2 inches long by 4·3 inches wide at the edge and 3·2 inches at the butt; it is 2·1 inches thick. Roughly made of light grey and brown mottled chert; neither in finish nor in the quality of the stone does it approach No. 18. Level, 3 ft. 6 in. below surface. House VIII, Block 2, VS Area.

No. 18 (B 728) is 9·9 inches long by 4·15 inches wide at the edge and 3 inches wide at the butt; it is 1·4 inches thick. It has been carefully chipped into shape from chert of good

[1] These were used as hoes, and it is possible that the examples from Mohenjo-daro were employed as ploughshares.

quality and is dark grey in colour. Level, 6 feet below surface. Street between Blocks 2 and 3, B Section, DK Area.

No. 19 (VS 2079), which is broken, is 9·3 inches long by 3·5 inches wide near the edge, and an average thickness of 1·75 inches. It is made of coarse brown chert and unfinished. Level, 5 feet below surface. North-western corner of House XXV, VS Area.

Dish-Borer (Pl. CXXX, 35)

Egypt. This is the only stone drill (VS 256) that has been found at Mohenjo-daro. From its shape it must have been used to fashion the interiors of stone bowls and dishes. The implement is made out of a hard, greyish-black stone resembling a fine-grained basalt. It measures 7·4 inches long. The upper side is slightly concave, the bottom convex, and the two ends are very strongly bevelled. This drill was worked by means of an upright forked stick that fitted the recesses in the sides. It is not known whether the movement was circular or to and fro, but either way would be quite effectual. A very similar drill has been found in Egypt, but its date is uncertain.[1] Level, 4 feet below surface. House XXIV, Block 3, VS Area.

Burnishers (Pl. CXXX, 10, 32, and 36)

Triangular shape. Nos. 10 (HR 4612) and 32 (L 514) are spindle-shaped objects of highly polished chert with the ends tapering to blunt points. They are triangular in section, but with the angles rounded off. No. 10 was found 2 feet below the surface in House LIV, Block 7, Section B, HR Area; and No. 32 was unearthed at the level of 2 feet below the second pavement in Chamber 30 of L Area, and belongs to the Late Period. A portion of each is unfortunately missing.

No. 36 (C 1853) measures 7 inches long and is 0·65 inch thick in the middle. It is made of polished chert. It resembles in every way the two burnishers just described. Level, 3 ft. 9 in. below surface. Chamber east of Room 25, Block 11, Section C, DK Area.

Used on metals. These burnishers could have served several purposes, but from the very hard stone of which they are made and the care with which they were polished, it is probable that they were used on metal. The last especially is a fine specimen of the lapidary's art.

Mace-heads (Pl. CXXX, 1–3; Pl. CXXXIV, 25–30)

Materials. Mace-heads of stone were certainly used as weapons by the inhabitants of Mohenjo-daro; they have been found in sufficient numbers to show that they were in common use. They were made in alabaster, sandstone, cherty-limestone, and also in a hard, green-coloured stone somewhat resembling slate.

Types. Three distinct types occur, namely, (*a*) pear-shaped, (*b*) lentoid, and (*c*) of the shape shown in Pl. CXXXIV, 27.

Type (*a*) (Pl. CXXXIV, 25 and 26).—The mace-heads of this type closely resemble specimens that have been found in Elam, Mesopotamia, and Egypt from the earliest times.

Pear-shaped. No. 25 (VS 679) is well made and shaped, of a hard black stone[2] which is highly polished. It was found at a depth of 6 ft. 6 in. below the surface, and is of Intermediate date. House XXI, Block 3, VS Area.

No. 26 (HR 4625) is of alabaster. It was found quite fortuitously by a basket-boy just outside the HR Area.

[1] Petrie, *Tools and Weapons*, pl. lii, fig. 73.

[2] Hornblende (?).

Lentoid.

Type (*b*) (Pl. CXXX, 1–3 ; Pl. CXXXIV, 28–30).—No. 28 in Pl. CXXXIV (DK 2862) is made of well-burnt pottery and there is, therefore, some doubt whether it really is a mace-head. It certainly resembles one in shape, but the hole through it is the same diameter throughout. East of Room 5, Block 2, Section B, DK Area. Level, 4 feet below surface.

No. 29 (VS 2393) is made of a hard olive-green stone with a smooth, but unpolished surface. Its hole is very regular, but the circumference of the mace-head is not a perfect circle. It was found 6 feet below the surface of the ground and is of Intermediate date. Western side of House XIII, VS Area.

No. 30 (HR 4078) is of sandstone with a smooth, but unpolished surface. It, too, is irregular in shape, but has a well-drilled hole. It was found 3 feet below the surface in Section B, Block 5, House XXVII, Room 31, of the HR Area, and is of the Late Period.

Nos. 1–3 in Pl. CXXX are illustrations of the same type of weapon :—

No. 1 (VS 1957) is 4·2 inches in diameter and 1·8 inches thick, and made of a compact cream-coloured limestone. The hole is ·65 inch in diameter at the surface on either side and slightly smaller in the middle of the stone. Level, 6 ft. 6 in. below surface. Room 113, House XVII, Block 2, VS Area.

No. 2 has no catalogue number ; it was picked up outside the area of excavation. It is made of grey granite and measures 2·85 inches in diameter by 1·35 inches thick. The hole through its centre is 1·1 inches in diameter at each end and 0·65 inch in the middle.

No. 3 (VS 3046), which is of a dark-coloured slate, is 4·4 inches in diameter and 1·65 inches thick. The hole through its centre is 0·8 inch in diameter throughout. Level, 4 feet below surface. Room 66, House XVII, Block 2, VS Area.

VS 74 (not illustrated) is a mace-head of alabaster, which measures 4·05 inches in diameter and 1·1 inches thick. Its hole is also of the same diameter throughout, namely, 0·6 inch. Alabaster is a very soft material for a weapon of this kind, and it is doubtless for this reason that this mace-head is rather badly damaged. Level, 1 foot below surface.

Effective weapon.

There is no doubt that the lentoid-shaped mace-head was a very effective weapon, even though the edge-like ridge around the middle was rarely sharp. Most of these heads were carefully made and they were, no doubt, valued possessions.

Elam and Egypt.

The lentoid type of mace-head is found in both the Intermediate and Late levels at Mohenjo-daro, and has also been found at Susa made in limestone.[1, 2] It does not seem to occur in the ancient sites of Mesopotamia, but a disc-shaped mace-head is found in the middle predynastic period of ancient Egypt. The latter, however, differs in some respects from the Mohenjo-daro type.[3]

Partially perforated.

Type (*c*) (Pl. CXXXIV, 27).—The only specimen of this type (HR 5035) is made of alabaster and has been badly weathered. Though the shape is very unusual—especially the beading around the hole at the base—the same type has been found at Harappā, but made in copper or bronze. The hole by which it was fixed to the shaft does not pierce through the head ; it only extends about three-quarters of the way through. This mace-head, which is of Intermediate date, was found 6 feet below the surface in Section B, Block 3, House XVI, Room 31 of the HR Area.

[1] *Mém. Dél. en Perse*, t. i, p. 194, fig. 420.

[2] De Morgan, *La Préhistoire Orientale*, t. iii, p. 101, fig. 1*a*.

[3] The lentoid form is, however, known in pre-dynastic Egypt. See Brunton and Caton-Thompson, *The Badarian Civilization*, pl. liii, fig. 9.

The same kind of beading as around the base of the above mace-head is to be found in several mace-heads from Anau[1]; the shapes of these are, however, entirely different.

* * * * * *

Biconical holes. The form of the holes through these mace-heads is the same in all but those of Type (*c*), which in shape also is radically different from the others. Similar biconical holes are known in the mace-heads of ancient Egypt, Mesopotamia, and Elam. They are thought to have been bored with the aid of wet sand and a hollow reed,[2] the boring being certainly done from both ends.

Pear-shaped mace. The pear-shaped mace-head is a very common type all over the ancient world, especially in very early times. It was used by the neolithic Cretans, in early Thessaly, by the people who occupied Sardinia in the chalcolithic period, and by the peoples of the Caucasus and Danube regions. It was common in pre-dynastic Egypt as well as in the early dynastic period, and it was extensively used by the early Sumerians.[3]

Method of securing to shaft. Mace-heads were probably not used bare, but lashed all over and thus firmly secured to a shaft. The latter was probably made of wood or, as Professor Petrie suggests, of hide,[4] which had a certain amount of spring; and care, therefore, had to be taken that the head was firmly secured to it. And it is likely that the lashings were of raw hide, which if applied green, would have become taut on drying. The mace-head is not used in Sind at the present day, but it still survives amongst the tribesmen of Mesopotamia, where, made of bitumen and pear-shaped, it is carried by nearly every man on even quite short journeys abroad.

Weights (Pl. CXXX, 25, 26, and 34; Pl. CXXXI, 20–35; Pl. CXXXIII, 9)

The large number of weights that have been found at Mohenjo-daro, in small houses as well as large, suggests that the housewife realized the necessity of checking the weights of the goods she purchased. These weights range from large examples that had to be lifted with a rope or metal ring to very small ones which were probably used by jewellers for weighing precious metals. The majority are cubical in shape, quite unlike those used in Babylonia. We have as yet found no scales; probably these were of very simple pattern, and if they were made of wood, as seems likely, they would have perished long ago.

The large number of the weights found is remarkable. I do not think any ancient site outside India has produced so many. They are not found in any special place, which might be a manufactory, but are well distributed all over the city. The careful way in which they are made and the hard stone of which they are composed suggest that the authorities had some surveillance over their manufacture; it may be that the use of false weights was a penal offence.

All the weights found at Mohenjo-daro have been examined and weighed by Mr. Hemmy, formerly Principal of the Government College, Lahore, whose results are given in Chapter XXIX.

Division into types. According to their shape the weights can be conveniently divided into seven types:—

(*a*) Cube-shaped.

(*b*) Spherical with flattened base and top.

[1] Pumpelly, *Excavations in Turkestan*, vol. i, pl. 167, fig. 390.

[2] Childe, *Dawn of European Civilization*, p. 24.

[3] Mackay, *Sumerian Palace and "A" Cemetery at Kish*, Field Museum, Chicago, pl. xxxvii, No. 3.

[4] Petrie, *Prehistoric Egypt*, p. 22.

(*c*) Cylindrical with flat base and top.
(*d*) Weights with hole for suspension.
(*e*) Barrel-shaped.
(*f*) Cone-shaped.
(*g*) Hemispherical.

Type (*a*) : *Cube-shaped Weights* (Pl. CXXXI, 20–35).—Cube-shaped weights were by far the most commonly used. Sometimes the cube is perfect, sometimes one measurement is smaller than the other two. The smallest weight that has been found of this type (DK 140) measures 0·3 by 0·3 by 0·25 inch, and the largest (B 165) 6·8 by 6·0 by 3·8 inches.

Material. Weights of this type were always made of chert, which is often beautifully banded or mottled. They were first roughly flaked into shape and then ground, and finally carefully polished. An unfinished weight (VS 3210) has been found that had only passed the stage of being flaked into shape (Pl. CXXXIII, 9). This specimen measures 4 inches square by 3 inches high, and was found 8 feet below the surface in Room 113, House XVII, Block 2, VS Area.

Descriptions. *Type* (*b*) : *Spherical weights with Flattened Base and Top* (Pl. CXXXI, 60 and 61).—Only six weights of this type have been found up to the present. The smallest of these (DK 2032), which is made of chalcedony, measures 0·7 inch in diameter at its equator and is 0·55 inch high. The flat top and base are 0·45 inch in diameter. Level, 4 feet below surface. From the street east of Block 4, Section B, DK Area.

The dimensions of the next in size (C 2974), which is made of flint, is 0·74 inch in diameter at its equator and 0·5 inch in height. The top and base are 0·5 inch in diameter. Its weight is 6·7 grammes. Level, 6 feet below surface.

DK 1265 is 1·1 inches in diameter at the equator and 0·9 inch high, with the top and base 0·7 inch in diameter. It is made of chalcedony and is unfinished ; there is no trace of polishing. Level, 2 feet below surface. Room 22, Block 4, Section B, DK Area.

DK 2255 is 1·1 inches in diameter at its equator and 0·9 inch high. The top and base are 0·65 inch in diameter. It is made of agate and weighs 27·2 grammes. Level, 1 ft. 6 in. below surface. Room 17, House VIII, Block 3, Section B, DK Area.

The two weights illustrated in Pl. CXXXI, 60 and 61, are both of large size. No. 60, the first and larger (VS 1821), is beautifully made in a hard, yellow limestone and measures 5·15 inches high. It weighs 5·556 kilograms, and was found 1 foot below the surface of the ground. House IX, Block 2, VS Area.

No. 61 (VS 1173) is made of cherty-limestone and is unfinished. It bears pick-marks all over its surface which it was perhaps intended to remove.[1] It stands 4·35 inches high. The weight of this object is now 2·792 kilograms, but if smoothed down it would have weighed considerably less than this. Level, 2 feet below surface. Between Houses XVIII and XXXIII, VS Area.

Rarity of type. With the exception of DK 1265 and VS 1173, these six weights were very carefully made. The rarity of specimens of this type suggests that they were used for some special purpose. They have not been found in Mesopotamia and are unknown in Egypt.[2]

Type (*c*) : *Cylindrical Weights with Flat Base and Top* (Pl. CXXXI, 41).—The weight that is illustrated (HR 19) is the only example of its type that has been found up to the present.

[1] It should be noted, however, that this particular weight is practically half that of VS 1821, which leads one to suspect that no further finish was intended.

[2] A weight of this type, from Aphrodisias in Caria, is in the Ashmolean Museum, Oxford. The type is said to occur also in Palestine.

It measures 1·8 inches in diameter by 1·4 inches high, and was found close to the surface of the ground.

Perforated weights. *Type (d): Weights with Hole for Suspension* (Pl. CXXX, 25, 26, and 34).—Three heavy conical stone objects with holes bored in their tops for a cord were probably used as weights. Their careful finish and great size make it unlikely that they were used as loom-weights.

No. 25 (HR 4618) is made of green slate and has a carefully smoothed surface. It is 8 inches high and its flat, semi-polished base is 5·8 inches in diameter. Holes, each 0·95 inch in diameter, bored diagonally downwards on either side of the apex, meet in the middle of the top of the stone. Level, 4 ft. 5 in. below surface. The weight could not be determined satisfactorily owing to the stone being badly chipped. Room 11, Structure L, Block 7, HR Area.

No. 26 (DK 3079), which is of grey limestone with a roughly finished surface, is 9·9 inches high. Its smooth, but unpolished flat base is 5·5 inches in diameter. There is a V-shaped hole through the apex, as in No. 25. Its weight is 10·262 kilograms. Level, 1 ft. 9 in. below surface. Room 2, House I, Block 1, Section B, DK Area.

No. 34 (VS 1899), made from light green slate, is 5·9 inches high, and its slightly concave base, which shows the polish of much wear around the edge, is 7·1 inches in diameter. The V-shaped hole through the apex is 0·85 inch in diameter. The weight is 6·903 kilograms. Level, 6 feet below surface. From Room 15, House VIII, VS Area.

Handles. These three weights were probably slung on a rope or metal ring. If the latter, the ring must have been included in the weight, and the weights, therefore, without such rings, would in consequence be only approximate. With such heavy objects as these, one would have expected to find evidence of a great deal of wear at the edges of the base where they were presumably dragged along the ground. No. 34 alone shows traces of this kind of wear.

Nāl. A weight, which is similar to these in every respect,[1] has been found, in conjunction with painted pottery, at Nāl in southern Balūchistān. Weights of this shape are also known at Harappā in the Panjāb and are still in use in India. I can find no evidence of their occurrence outside India, despite their simple and somewhat obvious shape.

Type (e): Barrel-shaped Weights (Pl. CLIV, 5 and 7).—Only three examples of this type of weight have been found at Mohenjo-daro, though more specimens are known from Harappā.

Description. No. 5 (HR 1115) is made of a dark-grey slate with an unpolished surface. It is slightly chipped at one end, and measures 1·92 inches long by 0·55 inch in diameter in the middle and 0·3 inch at the ends. Weight 14·019 grammes. Level, 2 ft. 6 in. below surface. Court of House VII, Block 3, Section A, HR Area.

No. 8 (VS 2509) is 2·18 inches long by 0·79 inch in diameter in the middle and 0·4 inch at the ends. It is made of a hard black stone,[2] and weighs 33·553 grammes. Perfect and moderately polished. Level, 5 ft. 6 in. below surface. House XII, Block 2, VS Area.

C. 315 is made of a hard black stone similar to VS 2509. It is 3·3 inches long by 0·85 inch in diameter in the middle and 0·5 inch at the ends. As this weight was in places very badly chipped, it was not weighed. Level, 6 feet below surface. Chamber 14, Block 12, Section C, DK Area.

Known in Egypt. This type of weight was used in Egypt, where it was frequently made of hæmatite. It is found in considerable numbers in Mesopotamia, where in early times (pre-Sargonic) it

[1] *Mem. Arch. Surv. Ind.*, No. 35, pl. xv (*b*), 78.

[2] Apparently hornblende.

was made of limestone and even alabaster, and in the later periods of hæmatite. Weights of this shape were also common in early times in Elam, where they were made of limestone, marble, granite, and other stones.

Various.

Type (f): Cone-shaped Weights (Pl. CLIV, 6).—No. 6 (DK 3131) is a conical object of hard black stone that may possibly be a weight. It measures 0·95 inch high with a flat base 0·72 inch in diameter, and is 15·264 grammes in weight. It is well made and carefully polished. Level, 3 feet below surface of ground. From street between Blocks 1 and 2, Section B, DK Area.

A piece of lead of conical shape (L 418) found in Chamber 104 of the L Area is thought to be a weight. Unfortunately, it was so corroded that its weight could not be ascertained with accuracy. It measures 1·4 inches high and has a flat base 0·7 inch in diameter. From its level it can be dated to the Late Period.

An object that may possibly also be a weight is seen in Pl. CXXXIV, 21. It is made of a hard black stone and stands 2 inches high. As at first it was thought not to be a weight, it was not put on the scales.

Type (g): Hemispherical Weights.—A limestone object (DK 7056), which is hemispherical in shape, 0·85 inch high and with a flat base 1·05 inches in diameter, is thought to be a weight. It weighs 26·5 grammes.

Weight of Indefinite Type.—VS 467 is a piece of limestone, weighing 13 grammes, which is slightly irregular in shape with a flattened top and base. Though irregular in shape, there is reason to think that it may have been used as a weight. Level, 5 feet below surface of ground. Room 4, House XXI, Block 3, VS Area.

Net-Sinkers (Pl. CXXXIII, 21; Pl. CLVII, 61)

Grooved stone.

This curious object (Pl. CLVII, 61, DM 285), of Intermediate date, appears to be a net-sinker. It is made of limestone and measures 2·5 inches high; its flat round base is 1·4 inches in diameter. A shallow groove, 0·15 inch wide by 0·1 inch deep, cut entirely round the stone, even across the base, was doubtless intended for a cord. Level, 7 feet below the surface.

Lead object.

A large circular piece of lead (L 394), measuring 6·7 inches in diameter and 1·4 inches high, was found just below the surface of the ground in Chamber 88 of L Area. It is flat on one side and slightly rounded on the other, and there is a roughly bored hole through the centre which, being almost square, seems to have been made with a chisel. From the flat base two holes were bored diagonally, one on each side of the central hole, which they joined in the middle of the object. Judging from the roughness of its surface, this net-sinker was cast in sand. The illustration in Pl. CXXXIII, 21, shows the underside of this object.

Whetstones (Pl. CLV, 8)

A considerable number of stone objects that have been found at Mohenjo-daro appear to have been used as whetstones. But the great majority of them are natural pebbles of slate or sandstone, and no attempt was made to bore or groove them so as to hang them on a cord, or to shape them in any way. Only the hone or rubber, which is illustrated and which is made of sandstone, was cut into a more or less regular shape. It was found at a level of 4 ft. 6 in. below the surface.

Anvils (?) (Pl. CXXX, 24)

Stone animals. Two objects of hard sandstone, both very carefully shaped into an animal form somewhat resembling a mongoose, seem much too heavy to have been children's toys. It is suggested that they were perhaps used as anvils for fine metal work. That shown in Pl. CXXX, 24 (D 457), measures 6·5 inches long by 2·1 inches high. The round eyes are very slightly in relief, and the legs short and rudimentary. Level, 5 ft. 6 in. below surface. Western end of Trench D, DK Area.

The second object (HR 2592), which is not illustrated, is 3·1 inches high and is very similar, though not so well made as the first. Level, 3 ft. 6 in. below the surface. Court of House VII, Block 3, Section A, HR Area.

Lattices (Pl. CXXXI, 43 and 46 ; Pl. CXXXIII, 10 and 11 ; Pl. CLVIII, 14)

Bevelling. No. 10 in Pl. CXXXIII (VS 2540) is a fragment only and measures 7·1 inches long by 0·9 inch thick. It is of alabaster, and well made and cut. The straight edge of this lattice-work is slightly bevelled, doubtless for the purpose of securing it in place. Both surfaces are perfectly flat. Level, 6 feet below surface. House XIII, Block 2, VS Area.

No. 11 (VS 2766) in the same plate is made of the same stone as the above, but is badly weathered. It now measures 4·8 inches long by 0·95 inch thick. Level, 7 ft. 6 in. below surface. Room 76, House XIII, Block 2, VS Area.

Windows. These two fragments of lattice-work do not belong to one another ; they were probably used for covering windows. Their design coupled with the natural translucency of the stone of which they were both made must have made them effective window ornaments.

Pottery gratings. A few fragments of pottery have been found at Mohenjo-daro that also appear to have been gratings. They are all flat pieces of pottery made of a porous clay, light red in colour and containing a little lime. The baking is rather harder than usual.

No. 46 in Pl. CXXXI (DK 1462), which is 0·95 inch thick, is typical of many other pieces. The incisions were roughly cut with a knife. Level, 3 feet below surface. Space 13 between Blocks 14 and 15, Section C, DK Area.

The fragment (C 160) illustrated in No. 43 of the same plate is rather more elaborate in design, and is further decorated with roughly scratched lines. Level, 4 feet below surface. Room 8, Block 12, Section C, DK Area.

A grating illustrated in Pl. CLVIII, 14, differs from the others just discussed. This object (HR 6148), which is made of some soft white paste and measures 2·32 inches long by 1·5 inches wide by 0·21 inch thick, was made in a mould and now bears no sign of having been glazed.[1] In all probability it once formed one of the sides of a small box. Level, 8 feet below surface. From Courtyard 39, House XVII, Block 3, HR Area.

Objects made of Pottery and Other Materials

Ballista Balls (?) (Pl. CXXXI, 44 and 45)

Clay and stone. A number of large round balls of baked clay or roughly chipped stone have been found in various parts of Mohenjo-daro. Similar objects in roughly baked clay, found in Mesopotamia, chiefly at the bases of city walls of the early periods, are thought by many to be ballista balls,[2] though there is no direct evidence that the large catapult was used in Sumer in early times.

[1] The paste, however, of which it is made is so soft as to have needed the protection of a glaze, which seems to have entirely disappeared.

[2] Banks, *Bismya*, p. 336.

No. 44 in Pl. CXXXI (SD 2199), which is somewhat irregular in shape, averages 2·6 inches in diameter. Found at a level of 3 ft. 3 in. below the surface in constructions (Block 4, No. 4) south of the Great Bath buildings.

No. 45 (SD 2310), which averages 2·6 inches in diameter, is also slightly out of shape. Recovered from Block 4, Southern Buildings Section. Level, 7 feet below surface.

Both these balls were roughly shaped from a coarse light grey chert by bruising the face all over, presumably with another stone. But it is possible, of course, that they were themselves used as hammer-stones to crush grain or even harder materials.

Oviform objects.

A number of egg-shaped objects of badly baked clay found in the SD Area average 3·75 inches long by 2·5 inches in diameter. They were found 4 feet below the surface inside, not outside, a building.

At the northern end of Chamber 45 in L Area, fifty or more of these egg-shaped lumps of badly burnt clay, averaging 4 inches long and 2·5 inches in diameter, were found carefully stored in a large pottery vessel.[1] Further south in the same area quite a number of large pottery balls were found lying in confusion upon the ground outside a very thick enclosure wall. Their shape, material, and the spot where they were found certainly lead us to regard them as weapons of offence or, rather, of defence.

Sling Balls (Pl. CXXX, 4 and 5)

We are on surer ground with regard to the sling-balls of which so many have been found at Mohenjo-daro, and it is clear that in ancient times the sling was known and used in the Indus Valley, as in Sumer and Anau in Turkestan.

Types of sling-pellets.

Two types of sling-pellets are found at Mohenjo-daro ; one round and about the size of a large marble, the other, which is more rare, ovoid in shape and averaging 2·5 inches long by 1·6 inches in diameter. No. 4 (L 730) and No. 5 (L 642) in Pl. CXXX illustrate the ovoid form ; this type occurs at all levels. Both types were made by hand with varying degrees of finish. In all cases they were baked. The round pellets may have been propelled by a sling of ordinary type or by means of a bow such as is used in Sind at the present day for killing small birds. No. 4 was found in Chamber 9, Block 5, and No. 5 in Chamber 65, Block 2, of the L Area. There must have been some reason for making the ovoid form of bullet ; perhaps this shape imparted a spin to the projectile and made it more accurate in its flight. The form would also, I am told, lead to a certain amount of ricochet and thus increase the chances of a hit. On the other hand, it should be remembered that the original sling pellet was doubtless a water-worn pebble, which is much more commonly ovoid in shape than round. There is no doubt that in ancient times the ovoid form of sling-pellet was preferred in some countries, for it is commonly found made both of baked clay and dressed stone.

Reason for shape.

Foreign connections.

Both ovoid and round sling-pellets have been found in early Sumer[2] and Turkestan,[3] as well as in India. No specimens have been found at Susa,[4] as far as I am aware, but Herzfeld has recently unearthed ovoid sling-pellets in neolithic settlements on the Iranian

[1] The same kind of thing has been found in a large pre-Sargonic building at Kish (P.). Those lumps, however, were of unbaked clay.

[2] I have found them at Jemdet Nasr and their use extended down to neo-Babylonian times. Mackay, *A Sumerian Palace*, pt. ii, pl. xliv, fig. 3. Also Hall and Woolley, *Ur Excavations*, vol. i, p. 53.

[3] Pumpelly, *Explorations in Turkestan*, vol. i, p. 164, fig. 364.

[4] Since this was written I have found a specimen from Susa illustrated in *Mém. Dél. en Perse*, t. xx, p. 108, fig. 11. This is dated to the Second Period.

table-land; he dates them prior to the First Period of Susa.[1] Further west, the sling was certainly in use in later times in both Palestine and Syria, but not in Egypt, where it was introduced at a still later period.[2] Petrie has pointed out that in twelth dynasty scenes in which the sling is represented the weapon is only carried by Syrians.[3]

Sling. The sling probably originated in a stony country where ammunition would be plentiful. When its use extended to alluvial countries the pellets would naturally have been made of pottery. It is essentially a weapon for open country, and in the hands of a skilled man is a formidable weapon.[4] Quite possibly it was introduced into India from the west; and at a very early period, as the specimens from Mohenjo-daro prove.

Flesh-rubbers (Pl. CXXXIII, 13–17)

A very unusual barrel-shaped object of pottery (VS 3612) must certainly be a flesh-rubber. It is pictured in Pl. CXXXIII, 14, and measures 8·8 inches long by 3 inches in diameter in the middle and 1·15 inches in diameter at each of the slightly rounded ends. The clay of which this object was made was heavily mixed with angular grains of sand with the result that the surface is very rough; indeed, the sand is so plentiful that there was only just sufficient clay to bind it together.

Use for ablutions. A flesh-rubber such as this would probably have been used for ablution purposes, and as it is hollow, it was light enough to be easily held in the hand. Found in Chamber 37, House I, VS Area, at a level of 3 feet below surface.

No. 13 in Pl. CXXXIII (D 368) measures 7·4 inches long by 3·5 inches in diameter in its middle. One end is pointed and the other flat. The rasp, which is hollow, is made of a light red clay plentifully mixed with sand. It shows evidence of much use on one side, which in consequence has become slightly flattened. Level, 10 feet below surface. Trench D, DK Area.

Of this form of rasp quite a number have been found, mostly in a broken state, showing that their use was extensive. It is found in both the Late and Intermediate Periods.

Second type. Another form of rasp (HR 3121), shown in Pl. CXXXIII, 15, is of quite a different pattern. Though also barrel-shaped and elongated, measuring 3·2 inches long by 0·85 inch in diameter in the middle, one side is flattened and made rasp-like by pricking it all over. This type of rasp was easily and cheaply made of such a material as pottery; but it was liable to be worn smooth, as, indeed, happened to the specimen described, which was found at a level of 7 feet below the surface in Room 49, Structure V, Block 2, Section B, HR Area.

No. 16 (also HR 3121) is 3·25 inches long and 0·6 inch thick. It has a rounded back and slightly concave surface, and is hand-made and hard-baked. Level, 7 feet below surface. Room 136, House X, Block 2, Section B, HR Area.

No. 17 (HR 966) measures 4·1 inches long and 1·95 inches broad. The back is rounded and the slightly concave face has been roughened in more or less regular lines. This roughening became smooth through regular use and the rasp was discarded on this

[1] *Illustrated London News*, 25th May, 1929.

[2] According to Sir Arthur Evans, there is "no evidence of Minoan use of slings", but he remarks that "this form of missile (sling-stone) had an early vogue on the Mainland side". See Evans, *Palace of Minos*, vol. ii, pt. i, p. 345.

[3] Petrie, *Tools and Weapons*, p. 36. Note, however, the slings of plaited linen thread recently taken from the tomb of Tutankhamen. As, however, these slings were found in a play-box, they may possibly have been looked upon as playthings or curiosities only. *Illustrated London News*, July 20th, 1929.

[4] Judg. xx, 16.

account. Hand-made, of superior clay and hard-baked. Level, 4 feet below surface. Chamber 125, House X, Section B, HR Area.

Heavily fired.

Rasps of the shape just described are fairly common at Mohenjo-daro. Some of them have been almost vitrified in the kiln in the attempt to make a more durable article, but the teeth have in every case been entirely worn down. Practically all the specimens found have a slightly concave face, doubtless in order that they might more easily fit the surface of an arm or leg, while rubbing it down.

Rubbing the body with a rough substance to cleanse it is practised in India at the present day, fine sandstone being used wherever it can be procured. And rasps of pottery, to be used for this purpose, can be purchased in most bazaars.[1] The same method of cleaning the body seems to have been customary in Mesopotamia in pre-Sargonic times, for we found in a cemetery at Kish that almost without exception a piece of fine white sandstone was buried with the dead, though it occupied no particular position in the grave.[2]

Spindle-whorls (Pl. CXXXI, 62–71 ; Pl. CLVI, 8–10 ; Pl. CLVII, 36, 40, 41, and 47)

Weaving.

Spindle-whorls are found in such numbers at Mohenjo-daro that the art of weaving must have been practised extensively. We know for a certainty that cotton was one of the materials used for this purpose, and there can be no doubt that wool was also employed as the sheep was well known, being one of the many animals portrayed in clay. Whether flax was grown we do not at present know, but there is a strong probability that linen was used also for garments, as was the case in early Sumer and Egypt.

Materials.

Spindle-whorls were mostly made of pottery, but there are some of shell and many of faience. The pottery whorls are of three types :—

(*a*) With a single hole in the middle.
(*b*) With two holes in the middle.
(*c*) With three holes in the middle.

Types of spindles.

The spindle used with the first type of whorl was a plain wooden stick, as shown by the size of the hole that it fitted. With the two-holed type a partially cleft stick must have been used, and the fact that the holes are invariably small suggests that the two separate ends of the stick were sharpened to fit them. It is uncertain whether or not a stick was used with the three-holed type of whorl, but there would be no difficulty in splitting the end of a wooden spindle into three parts to fit into the holes.

Two-holed whorls.

No spindle-whorls, except of the first type, were found at Jemdet Nasr, but the two-holed type has been found by Campbell Thompson at Abu Shahrein in Mesopotamia,[3] and also in early Elam[4] and Turkestan.[5] The three-holed type seems peculiar to the Indus Valley civilization.

Spindle-whorls of the first type are very common and generally indifferently finished, if in pottery. In some cases they were actually cut from broken potsherds and more or less roughly rounded. They vary considerably in size, ranging from 1·25 inches to 2·1 inches in diameter. The top is generally rounded and the base flat, but sometimes the base is slightly concave.

[1] Of practically identical shape.
[2] *Report on the Excavation of the "A" Cemetery at Kish*, Field Museum, Chicago, p. 15.
[3] *Archaeologia*, vol. lxx, pl. x, *b*.
[4] *Mém. Dél. en Perse*, t. i, p. 118, fig. 203.
[5] Pumpelly, *Explorations in Turkestan*, vol. i, pl. xli, fig. 21.

Grooved edges. Some of the two and three-holed whorls have a deep groove, averaging 0·1 inch wide by 0·15 inch deep, around the edge. The reason for this groove is difficult to fathom. It could hardly have been used for winding thread, as it would take but little. It is, however, possible that the thread was drawn along it to consolidate the fibres, though it could not be said that the grooves of any of the whorls show any signs of wear.[1]

Shell whorls. The spindle-whorls made of shell (Pl. CLVI, 8–10) are somewhat rare. They range in size from 1·5 inches to 1·85 inches in diameter and the single hole in the centre averages 0·18 inch in diameter, which suggests that a metal and not a wooden spindle was used with them. Shell spindle-whorls are all slightly out of the true owing to the curvature of the shell from which they were cut.

Unknown objects. Two strange objects, both of which are made of pottery and seem akin to the pottery whorls just described, are shown in Pl. CLV, 9 and 10. The first has a slightly concave base and a small hole running through it vertically, but the top is almost dome-shaped, instead of being gently rounded. The second is very similar in shape, but is of especial interest in that it is perforated by seven vertical holes, of which five are roughly in line. These holes are curiously enough not all the same size; the largest hole is in the middle and the smaller holes, four at the opposite poles, are near the edge.

Both these objects are of light red clay, and No. 10—which is so well made that it looks as though it had been shaped in a mould—was originally covered with a red slip. No. 9 is of rougher workmanship and is thickly covered with a white slip, upon which lines, that have now nearly all disappeared, were painted in red. Both these objects have a groove round the edge, which in No. 10 is 0·07 inch wide and 0·25 inch deep. The small size of the holes through them suggests the use of metal spindles, but it is doubtful whether they are spindle-whorls at all, despite their resemblance to the whorls with three holes. No. 10 was found in Courtyard (2), House LVI, Block 8, HR Area.

Faience whorls. Spindle-whorls of faience are also rare. In each the very small size of the one hole again suggests that they were fixed to a metal rod.[2]

No. 36 (SD 2040) in Pl. CLVII is 2·9 inches in diameter by 0·3 inch thick, with a flat base and slightly rounded top. The central hole is 0·15 inch in diameter. It is made of vitreous white paste with a circle of light blue and both the latter and the outer ring of white are delicately fluted. Level, 4 feet below surface. Outside western wall of Block 7, Southern Buildings Section.

No. 40 (DK 2948) is 1·4 inches in diameter by 0·3 inch thick, with the base slightly concave and the top rounded. The hole is 0·2 inch in diameter. The two glazes used on this object are now white and blue.[3] The outer ring is blue, then comes white followed by a narrow ring of blue, then a narrow ring of white, and the centre is blue. These colours were probably originally blue and green. Level, 3 feet below surface. From space between Blocks 1 and 2, Section B, DK Area.

No. 41 (SD 1894) is 1·4 inches in diameter and 0·4 inch thick. The hole is 0·15 inch in diameter and the base flat. The rounded upper surface is decorated with fluted radii, and the whorl was made of a soft white paste coated with a glaze which is now light blue in colour. It was found in the clay packing between the two brick piers on the northern side of the Great Bath, at a level of 6 feet below the surface.

No. 47 (SD 1231) is 1·4 inches and its hole 0·15 inch in diameter. The base is flat

[1] A similar shallow groove is cut around the edge of a whorl from Susa. This object, however, has only one hole for the spindle. *Mém. Dél. en Perse*, t. vii, p. 111, fig. 368.

[2] Metal rods were also used in Sumer. *Report on the "A" Cemetery at Kish*, pt. i, pl. xviii, 17.

[3] This blue is probably due to cobalt.

and the rounded upper surface decorated in the same manner as No. 41. The soft white paste is coated with a light blue glaze, which has probably changed from a darker shade. Found in one of the cells on the eastern side of the Great Bath. Level, 6 feet below surface. Nos. 41 and 47 were evidently made in the same mould.

Type found at Kish.

Small faience spindle-whorls very similar to those just described have been found in pre-Sargonic graves at Kish. One found in a grave of that period was mounted on a copper shaft.

Needles (Pl. CXXXII, 1–3 and 5; Pl. CXLIII, 20, 21, and 36 (?))

Bronze and copper.

Both awls and needles are somewhat uncommon at Mohenjo-daro. The needles are made of either bronze or copper and, owing to their thinness and the salinity of the soil, they have become barely recognizable—if they have survived at all. The badly corroded, wire-like pieces of copper and bronze that are constantly found possibly once were needles.

No. 1 on Pl. CXXXII (HR 300) no longer has a point and now measures 1·95 inches long. It was cut from a piece of sheet copper and is rectangular in section, 0·15 inch wide by 0·05 inch thick. The eye, which is oval and 0·1 inch long by 0·05 inch wide, was made by drilling a number of small holes close together and breaking away the intervening metal. Level, 3 feet below surface. Outside south-east corner of House I, Block 1, Section A, HR Area.

No. 2 (DM 187) is 1·81 inches long by 0·5 inch in diameter, and is made of bronze or copper. The eye appears to have been made in the same way as in the needle above. Level, 9 feet below surface. Stūpa Section, SD Area.

Bone.

No. 3 (HR 5127). Bone. It is possible that this object may be a needle, for it has a suspicious groove at the top, a portion of which is missing. It is very roughly made and is not completely round. It measures 5·07 inches long. If a needle, it must have been used in sewing a very soft and loosely woven material.[1] The point is much polished. Level, 6 feet below surface. Room 50, House XXX, Block 5, Section B, HR Area.

No. 5 (DK 430) is 3·1 inches long by 0·1 inch in diameter. The point is fine, but rather abrupt. The head of the needle has been badly damaged by corrosion, but there are indications that the eye was formed by bending the head over, as in some of the pre-Sargonic needles at Kish, rather than by drilling a number of holes.[2] Level, 1 ft. 9 in. below surface. Room 5, Block 9, Section C, DK Area.

Awls (Pl. CXXXII, 4, 6–9, 11, and 12)

Metal.

No. 4 on Pl. CXXXII (L 340) is of copper or bronze, and measures 4·12 inches long and 0·12 inch in diameter. It has a blunt point at one end and a graduated one at the other. Level, 4 feet below surface. Space 91, Block 9, L Area.

No. 6 (SD 2511) appears from its colour to be copper. It is 3·52 inches long and 0·1 inch in diameter at its thickest part. It has a point at each end, the lower one being very fine and sharp. Found in Court 4, in the constructions south of the Great Bath, at a level of 3 feet below the surface.

Bone.

No. 7 (VS 851). Bone. Measures 2·85 inches long. Round in section with one side slightly flattened. Good polished point at one end. From the rough nature of the other end this awl would seem to have been set in a handle. Level, 3 ft. 6 in. below surface. Between Houses XVIII and XXII, Block 3, VS Area.

[1] Perhaps also matting.

[2] *Report on "A" Cemetery at Kish*, pt. 1, pl. xix, 11.

No. 8 (HR 5765). Bone. Point broken and missing. Now measures 4·43 inches long and 0·31 inch in diameter at widest part. Evidently made to be set in a handle. Shows a polish due to much use. Level, 7 feet below surface. Room 50, House XXX, Block 5, Section B, HR Area.

No. 9 (HR 6041). Bone. 4·25 inches long. Diameter at thicker end 0·37 inch. Blunt point. Very much polished. Level, 9 feet below surface. Room 87, House IX, Block 2, HR Area.

No. 11 (HR 4398). Bone. 2·6 inches in length with a rounded top. Level, 2 feet below surface. Room 37, House XXIX, Block 5, Section B, HR Area.

No. 12 (DK 4563). Bone. Rectangular in section, rounding to the point. 2·93 inches long and 0·25 by 0·21 inch at its broken butt. The rectangular end is decorated on each side with two incised circles set one within the other. This object may once have been of the same nature as the objects depicted in the lower part of Plate CXXXII and then converted into an awl. Level, 9 feet below surface. Room 9, House I, Block 10, DK (*g*) Area.

Ladles (Pl. CLVI, 26–9)

Shell. The four ladles illustrated in Pl. CLVI are all made of shell. They vary considerably in size, the largest being 6·8 inches long.

Each ladle was made from a single piece of shell and its size, therefore, was in a measure governed by the size of the shell from which it was cut.[1] These objects are naturally irregular in shape, but are otherwise well finished and finely polished. Very similar ladles were used in Mesopotamia in very early times.

No. 26 (HR 2528) measures 2·58 inches long and is well preserved. It was found at the northern end of the main street (HR Area) at a depth of 4 ft. 3 in. below the surface of the ground.

No. 27 (SD 2617) is 3·55 inches long.

No. 28 (SD 1407) measures 4·65 inches long, and was unearthed from a depth of 11 feet in Room 15, Block 4, Southern Buildings Section.

No. 29 (SD 951), measuring 6·8 inches long, came from Chambers 5 and 6, Block 3, Southern Buildings Section, where it was lying at a depth of 4 feet below the surface of the ground.

Ritual use. It is possible that these spoon-like utensils were used for oblations and also for drinking from, especially the smaller sizes.[2] An exact copy of one (HR 5673) in baked clay was found in the HR Area (Pl. CXXXIII, 12). **Pottery metal.** This copy is rather larger in size than the usual shell ladles, but it is doubtful whether one so large could have been made of shell for want of a shell of sufficient size.[3] The pottery model measures 6·5 inches long, including its handle, and is made of a well-kneaded clay, now light red in colour, that contains a little lime in the form of small particles. Even the slight thickening present on the edges of the shell ladles has been imitated in this pottery model. Found 6 feet below the surface in Passage 20, House XVIII, Block 4, HR Area.

Shell ladles are found in both the Intermediate and Late levels at Mohenjo-daro, and they will probably be found to occur in the Early levels also.

[1] *Murex* (*chicoreus*) *ramosus*, Linn. (Red Sea, Indian Ocean, etc.)

[2] They are used by Hindus at the present day in sacred ceremonials. The Sanskrit name for these dippers is *argha*.

[3] Since writing this I have ascertained that some shells of this species attain a length of over a foot.

Handles (Pl. CXXXII, 14–18)

Faience.

No. 14 (HR 1546) measures 1·2 inches long by 1·0 inch in diameter at its thickest part and has a hole 0·32 inch in diameter through the centre. It is made of faience, which is now a light green colour, and is decorated with three grooves, each 0·1 inch wide by 0·1 inch deep. Each of these grooves contains a black substance that looks like bitumen. Level, 7 ft. 6 in. below surface. From between Houses III and VI, Section A, HR Area.

Ivory.

No. 15 (VS 2651) measures 2·15 inches long by 0·65 inch in diameter at its widest part. The upper portion of this specimen is missing, but the lower has a hole 0·25 inch in diameter. This handle, which is made of ivory, is well carved and shows a polish due to much handling. Level, 3 feet below surface. From Chamber 76, House XIII, VS Area.

Jaisalmir stone.

No. 16 (HR 5655). Inside this handle, which is made of yellow Jaisalmīr stone, there still remains traces of the copper or bronze tool to which it was once attached. The hole is 0·15 inch in diameter. This handle, which shows the polish of much use, measures 2·1 inches long by 0·95 inch in diameter. Level, 4 feet below surface. Room 8, House XXXVI, Block 5, HR Area.

Incised decoration.

No. 17 (HR 5409) is decorated in the same manner as No. 15, and, like it, is made of ivory. It measures 2·3 inches long by 1·45 inches in diameter at its widest part. It has a round hole, 0·2 inch in diameter, right through its centre longitudinally. The top of the handle is flat and somewhat roughly finished, suggesting that it was once capped with metal. The incised decoration upon it is divided by grooved lines into four registers, each containing a wavy line. The handle was first made upon a lathe. Level, 4 ft. 6 in. below surface. House XVIII, Block 4, Section B, HR Area.

Inlay.

No. 18. In design this handle is similar to No. 14, but the greater part of its inlay is still in place. The upper portion is missing and the handle is now 1·32 inches long and 0·8 inch in diameter. There is a hole at the top of the handle, now 1·15 inches deep and 0·21 inch in diameter. This hole once extended through the base of the handle, but has been stopped up with the same coloured paste as forms the inlaid bands around it. The handle is made of a hard paste, grey-green in colour. The inlay is of a softer paste and cream-coloured. There is now no trace of glazing on the outside.[1]

Small size.

The small size of all these handles is remarkable ; it suggests that, like the modern inhabitants of Sind, the people who used them had very small hands. It is very probable that the handles of the majority of knives and other implements were made of wood and that it is for this reason so few have survived to the present day.

Comparisons with Kish.

These inlaid handles are not unlike some made of faience that have been found at Kish ; dated there to the pre-Sargonic period. The main difference between them is that the bands on the Sumerian examples are mainly spiral.[2]

Cake Moulds (Pl. CXXXIII, 7 and 8)

No. 7 in Pl. CXXXIII (E 946) is 4·25 inches in diameter and 0·7 inch thick. Depth of convolutions 0·5 inch. The base is flat and there are indications that the object was made on a piece of matting. There are traces of a cream slip. Trench E, DK Area. Level, 9 feet.

No. 8 (DK 1924) is 5 inches in diameter at its widest part, but is not entirely round. It is 0·7 inch thick and the depth of its convolutions is 0·5 inch. Though, like the first, this

[1] Compare this handle with one of pre-Sargonic date found at Kish. See Mackay, *A Sumerian Palace*, pt. ii, pl. xliii, No. 10.

[2] Mackay, *Report on the Excavation of the "A" Cemetery at Kish*, pt. i, pl. xviii, fig. 21.

object is a copy of a shell, it was not moulded from one, as the slight irregularity of the convolutions show. Coated with a cream slip. Level, 4 feet below surface. Chamber 1, House II, Block 2, Section B, DK Area.

Cake moulds. Both these objects are made of a clay that has burnt a light red in colour. They are exceedingly well fired. It is suggested that they were used as moulds for fancy bread or for shaping sweetmeats.[1] They cannot be described as rare, as quite a number of fragments have been found, though only one whole specimen, which is illustrated, has been unearthed so far. A square object allied in conception to the objects illustrated is also known. It has square-shaped ridges filling up its interior instead of a spiral one.

Objects of Uncertain Use

The objects that fall into this division are unfortunately many, and it must be left to the imagination of the reader to interpret their meaning. Those objects that are made of stone are described first, followed by those made of pottery and other materials.

Stone Rings (Pl. XXXVIII, f.; Pl. CXXX, 7, 9, and 30; Pl. CLV, 1; Pl. CLVII, 59)[2]

Find of stone rings. No. 1 in Pl. CLV is an alabaster ring which seems too large to have been used as a mace-head. It was found 3 feet below the surface of the ground and seems to be of the same type as the stone-rings described below. The stone-ring pictured in Pl. CLVII, 59 (HR 2184a), which was found in Court 6 of House II, Section A, HR Area, is very similar in shape but of small size, measuring 3·5 inches high by 6·3 inches in diameter. The central hole is 2·85 inches in diameter. The best examples, however, are illustrated in Pl. CXXX, 7 and 9. **Find-spot.** These two massive rings of stone were found with many others in Section B, Block 2, House 5, Room 49, of the HR Area, at a level of 3 to 6 feet below the surface of the ground. The walls of the chamber in which they were found are of Intermediate date, but it is not certain whether the rings themselves are of the Intermediate or Late Period.

Dimensions. The dimensions of No. 7 (HR 5925) are 10 inches high and 16·7 inches in diameter at the widest part; No. 9 (HR 2810) is a little larger. These two rings, together with the fifteen others that were found with them, are made of limestone and each has a hole bored through the centre, varying from 4·6 to 8·2 inches in diameter.

On one side only No. 7 has two small dowel-holes, each 0·5 inch in diameter and 1·0 inch deep, on opposite sides of the large central hole. There also are two slots, each 0·9 inch long and deep, alternating with the dowel-holes; these slots are cut on the edge of the large central hole. Only three stones out of the seventeen found in the cache were found to be provided with these slots (Pls. CXVIII, 17; CXXX, 7 and 9).

The presence of these dowel-holes and slots suggests that it was intended to fasten the stones provided with them to something that was passed through their central apertures. The very large size of the latter in ring No. 7—it is 4·6 inches in diameter—indicates that the material to which the stone was fixed was either wood or stone, and it may be inferred that a dowel—perhaps a metal one—was passed at right angles through this wooden or stone stem, so that its ends engaged the slots in the ring and prevented the stone from either sliding down or from turning on its support.

As these stone-rings were found in a heap and vary in size as well as in the bore of the central hole, it seems evident that they do not belong to one another, but had been gathered

[1] Cake-moulds of exactly the same pattern but made in metal are, I am told, in use at the present day in parts of the Madras Presidency.

[2] For these and other ring-stones, see Chap. V, pp. 61–3.—[Ed.]

together for some unknown purpose. The dowel-holes suggest that such stones were placed on top of one another to form a kind of pillar, each being fastened to the one above or below to prevent twist. Unfortunately for this theory, only nine of the stones have dowel-holes, and no two stones are uniform.

However this may be, the presence of these dowel-holes in some of the rings proves to my mind that these stones served some architectural purpose; they could, for instance, have been used as capitals for wooden columns.[1] It is also suggestive that with them was found the capital pictured in Pl. CXXX, 22.

Eight of the stones have small circular pittings placed closely around the edge of the central hole (Pl. CXVIII, 16). It is possible that these once served as identification marks. If this be so, the markings may imply that the stone ring upon which they appear had a definite allotted place with regard to other stones marked in the same way.

There is no doubt that being of different sizes the stone rings that were thus found together in the HR Section had been collected for some other than their original purpose. Many were badly broken and weathered before they were gathered together, which suggests that it was not intended to apply them again to their original purpose. It is possible that they were to be cut up and made into something else.[2]

Rings with Wavy Tops and Bases (Pl. CLVI, 2–5; Pl. CLVII, 56 and 57)

Rings of wavy shape.

Five objects found at Mohenjo-daro, two of shell and three of alabaster, are difficult to identify. They range in size from 1·05 inches to 2·5 inches in diameter, but at Harappā both small and large stones of this shape have been found, of which the latter, usually made of grey or yellow limestone, are as much as 2 ft. 9 in. in diameter (Pl. XIV, 6 and 8). These stones seem to be allied to the large stone rings that are common to both Mohenjo-daro and Harappā, which have been described above. In fact, they only differ from them in the wave-like surface of the top and base.

Descriptions.

No. 56 in Pl. CLVII (HR 257) is made of alabaster. When complete, the hole running through its centre was 1·35 inches in diameter. The ring is 1·05 inches high by 0·75 inches thick, and is well made but unpolished. Level, 5 feet below surface.

No. 57 (HR 326) is a small fragment. Its central hole was originally 1·3 inches in diameter and it is 1·2 inches high and 0·8 inch thick. Like the first it is of alabaster. Level, 3 feet below surface. Court 18, House I, Block 1, Section A, HR Area.

Another broken specimen in alabaster (L 834) was found 2 feet below the surface of the ground in Court 69 of the L Area.

A fourth example (HR 4891) measures 1·1 inches in diameter and 0·65 inch high, with the central hole 0·5 inch in diameter. Found in lane between Houses L and LV, Block 7, Section B, HR Area, 3 feet below the surface.

Somewhat allied to the above, but made in shell, are a pair of objects, one of which is illustrated in Pl. CLVI, 3. Each measures 0·62 inch in diameter by 0·51 inch high. They closely resemble the stone examples except that they are not perforated in any way. These two specimens may be unfinished, but otherwise they are well cut and highly polished. They were both found together at a depth of 4 ft. 6 in. below the surface, and their serial numbers

[1] The possibility may be admitted, though it seems a remote one, in the case of the large plain ring-stones, but not in the case of the large undulating ones; nor, obviously, in the case of the smaller ones which are sometimes not more than an inch or two in diameter. For a fuller discussion of these ring-stones, see Chap. V, pp. 61–3.—[Ed.]

[2] The inference here drawn by Mr. Mackay seems questionable. The room where the ring-stones were found may have belonged to a temple, and they may have been deposited there as cult objects.—[Ed.]

are VS 2187 and VS 2182. They are more fully described in Chapter XXVIII on Ivory, Bone, Shell, and other objects.

Comparisons with Kish objects. Though they presumably belong to one another, these two specimens do not exactly fit together. Possibly they alternated with similar objects made of paste or some other material. If so, they recall the curious rods made up of alternate sections of shell and bituminous limestone threaded on a copper rod that I found at Kish, belonging to the pre-Sargonic period, and that are also known at Susa and Musyān.[1]

Mace-like Objects (Pl. XIII, 11 and 12; Pl. CXXX, 6; Pl. CLVII, 55, 58, and 60)

Objects of unknown use. No. 6 in Pl. CXXX (VS 3175) is a curious object made of alabaster, which at first sight appears to be a mace-head, but evidently served some other purpose. It measures 1·95 inches high and its flat base is 2·35 inches in diameter. It is rounded at the top where four grooves at right angles radiate outwards from a vertical hole through the centre. This hole is slightly irregular in bore, the average diameter being 1·05 inches. There is also a horizontal hole in the side of the object near its base, measuring 0·75 inches in diameter and only 0·6 inch deep, so that it does not meet the vertical hole. The illustration of this object in Pl. CXXX, 6, shows it from above. Level, 5 ft. 3 in. below surface of ground. Room 62, House XXVII, Block 6, VS Area.

Descriptions. Nos. 55 and 60 in Pl. CLVII are two views of another object of alabaster (HR 1123), which also in some ways resembles a mace-head. This object is conical in shape, 2·75 inches high, with a flat base 2·75 inches in diameter. A hole, 0·95 inch in diameter, bored through its centre is smooth throughout and shows no particular wear. There is another hole, 0·5 inch in diameter and 0·6 inch deep, in the side of the object at a distance of 0·75 inch above the base. This second hole is at right angles to the central hole, but does not meet it. The top of the object is divided by deep grooves into four portions. It was found 4 feet below the surface of the ground. Chamber 5, House I, Section A, HR Area.

No. 58 in Pl. CLVII (HR 4943) measures 2·5 inches high and 3·1 inches in diameter at its widest part. The vertical hole that runs through it is 1 inch in diameter. The horizontal hole is 0·7 inch in diameter and 0·6 inch deep, but does not meet the vertical hole in the middle. The material is a very soft variety of alabaster. Level, 6 feet below surface. Room 102, House XII, Block 2, HR Area.

VS 2507 is another object of the same type and material, but is not illustrated. It is 2·5 inches high and 3·1 inches in diameter at the base, which is flat. The hole through its centre, 1·6 inches in diameter, is much larger than the others described above. This object also has a horizontal hole, 0·75 inches in diameter, but in this case the hole is continued right through to the centre. Level, 5 feet below surface. Room 76, House XIII, Block 2, VS Area.

Of VS 1530, which again is of the same material and shape, only a fragment remains. Level, 5 feet below surface. South-east corner of House XXII, Block 3, VS Area.

Possible cult objects. What these objects were used for it is difficult to determine. The broad flat base suggests that they were meant to stand on something rather than to be supported by a stick through the middle. And that they were not to be subjected to very much wear is proved by their being made of very soft material. They could hardly have been intended to have revolved on a stick, as none of the vertical holes through their middles show any evidence of wear, and yet the presence of the smaller horizontal hole near the base suggests that a stick

[1] *Mém. Dél. en Perse*, t. i, p. 121, fig. 253.

was used to turn the object round on a pivot. It is, of course, possible that these objects were connected with some cult. Similar objects, but made of pink limestone, have been found at Harappā.

Conical Stones (Pl. CXXX, 8)[1]

Stone cones.

No. 8 in Pl. CXXX (HR 2783) is a conical mass of white limestone, measuring 15·65 inches high, somewhat roughly made with an uneven base 7·5 inches in diameter, whose edge is slightly rounded. Level, 2 ft. 3 in. below surface. From First Street, HR Area.

HR 2079 is a very similar mass of cherty limestone, 8·3 inches high, with a smooth but unpolished surface. The flat base is 9 inches in diameter. The top of this cone is polished in places as if by constant friction of the hand. Level, 2 ft. 6 in. below surface. From the constructions south of Chamber 29, House I, Block 1, Section A, HR Area.

HR 587 is also a conical mass of cherty limestone, 6·5 inches high, whose flat and polished base is 5·7 inches in diameter. It is only roughly dressed and has pick-marks all over it. There is no sign of any polish except on the base. Level, 3 feet below surface. First Street between Sections A and B, HR Area.

Conical Stones with Heads (Pl. CXXX, 27–9 and 33)[2]

Cones with heads.

No. 27 (SD 207) is made of roughly dressed limestone, but the head shows signs of polishing, especially at the extreme tip and around the base. It measures 10·5 inches in height and its flat base, which also shows a considerable degree of polish, is 9·2 inches in diameter. Level, 2 feet below surface. From Chamber 1, Block 6, of Southern Buildings Section.

No. 28 (HR 201) is made of cherty limestone and carefully finished. This cone is 6·4 inches high with a flat base roughly 3·7 inches in diameter ; there is a shallow vertical hole 0·37 inch in diameter in the top of the cone. Although it is now badly chipped, its surface was formerly very smooth, though there are no signs of ancient polish. Level, 8 feet below surface.

No. 29 (SD 1567) also is made of a cherty limestone. It stands 11 inches high and has a very smooth base, 8·3 inches in diameter. It is only roughly dressed with a pick, except for the head which is polished. Found in the lane between Blocks 4 and 5 of the Southern Buildings Section, at a depth of 7 feet below the surface.

No. 33 (VS 2321) is similar to the others, but its apex has been badly knocked about. It is made of limestone and measures 13 inches high with a smooth flat base, 8·5 inches in diameter. It was found at a depth of 6 ft. 6 in. in Room 13, House XVII, of the VS Area.

In many respects these stones resemble the phallic object (*liṅga*) of the Hindus. The fact that nearly all of them are more or less polished at the top[3] suggests that they were constantly fingered ; possibly they were repeatedly anointed with butter as is the custom at the present day.

Small Cones with Pointed Tops (Pl. CXXXI, 47–55 ; Pl. CXXXIV, 8–20 ; Pl. CLVI, 19)

Clay cones.

A striking feature of the excavations at Mohenjo-daro is the great number of small cones that have been found, made principally of baked clay, but also of shell and in one case of lead.

These pottery cones occur in most of the rooms of both the Late and Intermediate periods.

[1] For the meaning of these stones see Chap. V, p. 59–60.—[Ed.]

[2] No. 28 of Pl. CXXX seems to belong to a different class from Nos. 27 and 29.—[Ed.]

[3] This polishing has not been caused by ordinary handling. The tip of the cone has as much or more polish as its lower part.

They are baked very hard and in some cases they are almost vitrified. One of the commonest forms is shown in Pl. CXXXIV, 11, 12, and 18. They average 2·75 to 3 inches in height, and have a small rough projection at the base, on account of which and in connection with their general shape, our basket-boys call them "carrots". Some of these cones are decorated —always at the base—with spiral lines of pittings, which show no trace of having been filled in with white or any other colour. Nos. 9 and 10 in Pl. CXXXIV are of shell and both came from the L Area. The first was found in Court 121, Block 6, and the second in region 128, Block 8. Both belong to the Late Period.

Flat-based variety. Another common form is the cone with a flat base (Pl. CXXXIV, 13 and 15), which unlike the "carrot" type, readily stands up. In this variety of cone, the base is but seldom decorated with pitted lines. When, however, this form of cone is decorated, the base is scored with from three to six horizontal lines, as in No. 13, or with spiral lines, as in No. 15. This type frequently has a small shallow hole in the centre of its base, averaging 0·15 inch in diameter and 0·03 inch deep. No. 13 was found outside the western wall of Block 7, SD Area, at a level of 4 feet below the surface.

Round-based cones. Round-based cones (Pl. CXXXIV, 14), which average from 1·6 to 2·5 inches in height, are also found in large numbers. Sometimes the base is quite plain, sometimes it is scored with a spiral line. Occasionally there is a shallow hole in the centre of the base.

No. 16 (VS 6178) in Pl. CXXXIV is a very curious form of cone. It is hand-made, with a small flat base, and is unusual in having a spiral line scored around the middle of the body.

No. 17 (DK 3090), which is made of light red pottery, is coated with a brown slip. Its receding base is uncommon in shape, and the hole in it is unusually long, measuring 0·6 inch in depth and 0·2 inch in diameter. Outside south-east corner of Block 2, Section B, DK Area. Level, 3 feet below surface.

No. 20 (SD) in Pl. CXXXIV is also of unusual type. It is hand-made with its base decorated with vertical lines of pittings that meet circular lines below. There is a shallow hole in the projection from the base, 0·15 inch deep and 0·2 inch in diameter at the surface.

Broken points. The purpose for which these cones were used has not yet been gathered. It is very rarely indeed that one is found with the point unbroken, and it is probable that this part of the cone was essential to its use and that breakage of the point led to the cone being thrown aside. In the rare cases in which the point is intact, it sometimes shows signs of having been carefully trimmed with a knife in the course of manufacture, which suggests that the point was used for boring.[1] On the other hand, it is very unusual to decorate tools and implements, yet most of these cones are decorated in some way, even to the extent of coating them with a smooth red slip—a finish which hardly seems necessary in the case of a simple tool.

Make. These pottery cones were sometimes hand-made, and sometimes made on a wheel. In the former case, they were so carefully finished that it is often difficult to distinguish them from the mechanical articles. Those which were decorated with scored lines, whether horizontal or spiral, were usually made on a wheel, and in some cases the scoring was done with a comb.

In colour the cones range from light red, sometimes coated with a dark-red slip, but more frequently left plain, to a dark-brown colour which almost approaches black. Many of the latter are made of a special clay of a very compact nature, and have been so heavily fired in the kiln that they are almost vitrified. This is especially the case with the "carrot" type of cone.

[1] Small clay cones from Jemdet Nasr were treated in a similar way.

Holes in bases. It is difficult to explain why there should be a hole in the centre of the base of some of these objects. In most cases it is much too shallow for the cones to have been fixed to any kind of handle. It is possible that these holes fitted a peg on the wheel on which the majority of the cones were turned, enabling the potter to finish off the base of the cone before removal from the wheel. But there is a possible objection to this in that some of the hand-made examples have a similar hole. In the latter case, however, a wooden peg stuck in the base of the cone would help in rolling it into shape and it would, of course, disappear when the cone was baked.

Use of in game (?) It is possible that these cones were used in some form of game and that they were thrown with the idea of making their apices point in a certain direction. If this were so, it would explain the existence of so many of them with broken points, and the fact that some of them were decorated would also point to this conclusion. It is certainly open to doubt whether such comparatively blunt points as those of Nos. 11, 12, 14, and 19 in Pl. CXXXIV would be of any use for boring.

Foreign comparisons. Pottery cones very much like those illustrated, but undecorated, have been found at Jemdet Nasr in Mesopotamia. Like the Mohenjo-daro examples they are associated with painted pottery and all of them had very carefully trimmed points. They most closely resemble in type No. 11 on Pl. CXXXIV, but are without the projection at the base.

Cones of various sizes have been found in other places in Mesopotamia. At Ur, for instance, they have been found in plenty. The use of some pencil-like varieties found on that site have not yet been satisfactorily explained.[1] Mr. Campbell-Thompson found a great many at Abu Shahrain,[2] and these, like the Ur examples, are of very early date and generally associated with painted pottery.

Shell cones. Nos. 8, 9, and 10 in Pl. CXXXIV and Pl. CLVI, 19, are made of shell—the only ones found at Mohenjo-daro—and on account of the hardness of this material their points have not been broken off. They are all somewhat roughly made, and the bases of two are rounded, the third flat. The cone illustrated in Pl. CLVI, 19 (HR 900) is 3·2 inches long; it was found inside the south-western corner of House I, Block 1, Section A, HR Area, at a level of 3 feet below the surface.

Small Cones with Rounded Tops (Pl. CXXXIV, 22–4; Pl. CLVI, 7)

Gamesmen (?) A small number of very carefully made cones with rounded tops were made of shell or pottery. The three illustrated in Pl. CXXXIV were all found together, 4 ft. 4 in. below the surface of the mound in Section B, Block 3, House 14, Room 11, of the HR Area. Each measures 2·2 inches high by 1·5 inches in diameter and is made of a light red ware whose surface is uncoated with a slip. The use of these three objects is uncertain. They are perhaps too large to be gamesmen.

No. 7 in Pl. CLVI (HR 5539) is one of a group of three, all beautifully made in shell. They were all found together, 3 ft. 3 in. below the surface in Section B, Block 8, House LXII, Court 36, of the HR Area, and average 1·9 inches in height and 1 inch in diameter at the base, which is flat. All the cones of this group are of Intermediate date.

Cylindrical Objects of Pottery (Pl. CXXXI, 42)

Pottery cylinders. Three very curious objects (HR 5751), pottery cylinders with flat ends, were found together in the HR Area at a level of 11 feet below the surface of the ground. They are of

[1] See Dr. Hall's remarks on these objects in *Ur Excavations*, vol. i, pp. 48–50. It is out of the question that the Mohenjo-daro examples were used for wall decoration.

[2] Campbell-Thompson, *Archaeologia*, vol. lxx, pl. x (*b*).

different sizes, one being 4·4 inches in length by 1·9 inches in diameter, another 4·05 by 1·8 inches, and the third 4·6 by 1·8 inches. A fourth object of the same kind, measuring 5 by 1·75 inches, was found at a level of 8 feet below the surface on the eastern side of the Stupa buildings, i.e., it belongs to the Late Period, whereas the other three are apparently of Intermediate date. The three cylinders were found in Room 74, House V, Block 2, Section B, HR Area.

Mode of manufacture. These four objects were all roughly made by hand and somewhat indifferently baked. The clay seems to have been rolled on a flat stone and then squarely chopped off in lengths. They have no slip and show no signs of wear at any particular spot. They were possibly used for rolling dough, but they seem rather short for this purpose.

Shell Caps (Pl. CLVI, 13, 16–18)

Shell objects. No explanation has at present been found of the shell objects illustrated in Pl. CLVI, 13, 16–18. They are always in two pieces which fit more or less correctly together, according to the skill of the carver, but two halves have never been actually found together. The decoration is always the same, namely, a deeply scored line around the edge of the rounded upper surface and quartering by means of three parallel lines. The lower surfaces of the two halves always show the convolutions of the shell and apparently no attempt was ever made to smooth them down.

When the two halves are placed together there is a natural hole between them ; and this, coupled with the fact that the top shows traces of a slight flattening, suggests that a small metal plate was placed on the top with a wire passed through it for a handle. Possibly a metal plate once covered the base ; if so, this would account for the lack of finish in this part of the object. These objects may have been used as jar covers.

Descriptions. No. 16. The two pieces of this cap do not strictly belong to one another (DK 2991 and DK (?)). When set together, they measure 2·85 inches in diameter and 1·02 inches high. Level, 18 inches below surface. House I, Block 1, Section B, DK Area.

No. 17. This illustration shows the appearance of the inside of one of these caps, made up of pieces DK 2899 and DK 2927. The two measure 2·4 inches in diameter and are 0·85 inch high. Levels, 3 feet and 2 feet, respectively, below surface of ground. Room 3, House I, Block 1, Section B, DK Area.

No. 18 (HR 324 and DK 3114). 2·4 inches in diameter and 0·7 inch high. DK 3114 was found 18 inches below the surface in Room 5, House I, Block 1, Section B, DK Area.

No. 13 is a rare example of three pieces of shell being used to make one of these caps. Two of these pieces belong together (HR 2465), but the third (HR 3198) is part of another cap. This type of cap is rare for the reason that it must have necessitated considerable labour to fit three pieces accurately together. Levels, 14 feet and 2 ft. 4 in. below surface.

These objects are found in both the Late and Intermediate levels.

Pedestal (?) (Pl. CXXXIII, 18)

Stand. This is an alabaster object (VS 2648) rounded on its upper surface and with a flat base 5·6 inches in diameter. Its height is 1·9 inches. In the centre of the upper surface is a shallow depression, 2·7 inches in diameter by 0·2 inches deep. The exact use of this object is doubtful ; it may be that it is a pedestal of some kind. Level, 5 ft. 4 in. below surface. From House IX, VS Area.

Roundel (Pl. CLVIII, 12)

Steatite ornament.

This curious object (HR 5463) is 1·9 inches in diameter by 0·3 inch thick, and is made of steatite. One side has been cut to a flat edge. In the centre is a heart-shaped design similar to the inlay of Nos. 39–44 in Pl. CLV. Close to the edge a number of lunar-shaped depressions have been cut. The use of this object is quite uncertain. It is too thick for inlay, and, as it is unbored, it cannot have been used either as a bead or a pendant. Its reverse is quite flat and unornamented. Level, 4 feet below surface. Room 87, House IX, Block 2, HR Area.

Pottery Tablets (Pl. CXXXI, 56–9)

Rough pottery objects.

The use of the four pottery objects in Pl. CXXXI, 56–9, has long been a puzzle. Similar specimens have been found in various parts of Mohenjo-daro, belonging to various periods. They vary considerably in size, ranging from 1·5 inches to 3·7 inches across one side. In thickness they vary from 0·7 inch to 1·3 inches, according to their size.

These curious objects are flat on both sides and always roughly made. In some specimens straw was mixed with the clay of which they are made. Most examples are of triangular shape with more or less rounded corners; a few, however, are circular, but these are rare. There are no indications on their upper or their lower surfaces to guide us as to their use; neither are these surfaces particularly well finished.

I was at first inclined to think that these pottery plaques were used as stands for pottery in the kiln, particularly as one has been found in the interior of a kiln. On the other hand, they are always so badly baked that they would seem never to have been exposed to any great degree of heat. Provisionally, I venture the theory that they represent model loaves, either as votive offerings or intended for burial use. They closely resemble the triangular loaves portrayed on tomb walls in Egypt.

Models of loaves (?)

No. 58 in Pl. CXXXI (VS 1025) measures 3·7 inches along each side and is 1·2 inches thick. House XXVI, Block 7, VS Area. Level, 4 feet below.

Chapter XXV

COPPER AND BRONZE UTENSILS AND OTHER OBJECTS

Part I

SOURCES AND METALLURGY OF COPPER AND ITS ALLOYS

Metals of the Indus people.

THE excavations at Mohenjo-daro have shown that the metals known to the early inhabitants of the Indus Valley were gold, silver, lead, copper, and tin as an ingredient of bronze ; iron was altogether unknown to them. Of these, copper was the earliest and the most useful metal at their disposal for general purposes, and objects of this metal, which have been found here in abundance, comprise domestic utensils, axe-heads or " celts ", daggers, knives, lance-heads and arrow-heads, sickles, statuettes, bangles, finger-rings and ear-rings, amulets, wires, rods, etc.

Copper abundant.

It is well known that pure copper is a comparatively soft metal and unfit for tools and weapons requiring a keen, hard edge. This was early understood by the Indus people who doubtless felt the need of a harder metal for their weapons as well as for their works of art. Whether they invented bronze independently or learnt the art from some foreign nation it is not at present possible to decide ; but it is certain that they became acquainted with this alloy at a very early period. Bronze objects discovered at Mohenjo-daro comprise utensils, tools and weapons, statuettes and jewellery. Most of these were evidently made by casting, but some had to be shaped and finished by hammering. Therefore, it is obvious that their makers were quite familiar with the property of bronze, that enables it to be forged at a temperature just below redness. The chemical composition (*vide infra*) of the bronze objects leaves no doubt that the tin, 4·5–13 per cent, is not accidental, but was added intentionally to produce an alloy suitable for cutting tools or other purposes. Some of these objects are in a completely oxidized state, consisting of a substantial core of white stannic oxide enveloped in a layer of red cuprous oxide, thus affording a visible proof of the use of a high-grade bronze. These facts lead us to the conclusion that at the time these objects were produced the Indus people had passed much beyond the experimental stage and had acquired a very good knowledge of the properties and working of bronze. In spite of this, however, it is noteworthy that pure copper tools and weapons persisted alongside with those of bronze even in the uppermost strata, where many fine specimens of bronze (e.g. saws, chisels, and vases) have been unearthed. The only possible explanation of this simultaneous use of copper and bronze is that the supply of bronze was limited and its use, therefore, was confined to objects of a special nature, e.g. tools, razors, jewellery, or ornamental vases for those that could afford them. Later on we shall see that the Indus people were handicapped in their efforts to develop the use of bronze, on account of the scarcity of tin in India and the difficulty of procuring it from abroad. We must also bear in mind that precious objects such as these were likely to have been passed on from one generation to another and to have been eventually carried away when the city was abandoned.

Use of bronze.

Advanced knowledge of bronze.

Tin scarce.

Copper-arsenic alloy.

Another alloy, composed of copper and arsenic (*vide infra*) and comparable with a low

grade bronze in hardness, is also met with at Mohenjo-daro. How it originated and when precisely it came into vogue, we do not know. It is possible that the addition of arsenic (2–4·5 per cent) was intentional, but it is more probable that some mines of arsenical copper ore were found to yield a very hard and yellowish metal which was much prized for tools, before the introduction of bronze in the Indus Valley. Objects of this alloy have also been found in early Egypt and at Anau.

Copper and bronze in Egypt, Sumer, and other countries.

In Egypt copper came into use very early in predynastic times, and there is evidence of a sporadic use of bronze during the Old Kingdom period, the earliest known object of this alloy being a rod found at Meydum, in a third dynasty tomb, containing 9·1 per cent tin. As the result of a careful survey, Montelius [1] comes to the conclusion that full tin bronze (9–10 per cent) came into use in the eleventh or twelfth dynasty, but according to Petrie it did not come into regular use until the eighteenth dynasty (*c.* 1580 B.C.).[2] Copper was commonly employed by the Sumerians from the earliest times, and copper casting was practised by them even before the reign of Ur-Nina (*c.* 2900 B.C.). Chemical analyses of the objects found at Tello, Eridu, and Al 'Ubaid have shown that tools of copper unalloyed with tin were in use even in late Sumerian times.[3] However, bronze objects have been found at Ur and Erech ranging from the second half of the third to the end of the second millennium. Recently several careful analyses by Dr. Desch of authentic specimens from Kish, Ur, and Al 'Ubaid have been published, which leave no doubt that bronze was employed by the Sumerians earlier than *circ.* 3000 B.C.[4] It is obvious that both copper and bronze were simultaneously in use in Mesopotamia before *c.* 3000 B.C. and that subsequently the alloy was employed sparingly even for tools, as in the Indus Valley. As we have stated above, this paucity of bronze was due to the scarcity of tin, and there is some documentary evidence also in support of this view. A record which is earlier than Sargon of Agade states that "five minas of pure tin" had been received at Lagash.[5] Sayce informs us that tablets from Kara-Euyuk also refer to tin which was "a rare and precious metal in Babylonia at the time (*c.* 2500–2200 B.C.)." It can hardly be doubted that the introduction of bronze in the Indus Valley and Babylonia was approximately contemporaneous, on account of the close commercial relations that must have existed between them. Copper appears in the earliest strata at Susa. At Anau, copper has been obtained in the later phases of Culture I and weapons of the pure metal were in use in Cultures II and III, with occasional bronze in the latter period.[6] In Crete, the Bronze Age begins even earlier than in Egypt, in the early Minoan I Period. In Cyprus, the Copper Age continued down to *c.* 2200 B.C., when the Bronze Period followed. Copper was in general use in the first settlement at Hissarlik, and bronze in the Second City which flourished probably much earlier than 2000 B.C.[7]

Early utensils of copper in Central India.

The discovery of numerous prehistoric copper implements (e.g. celts or axe-heads, swords, harpoons, etc.) at various sites in Northern India and the Central Provinces indicates that copper was extensively worked in India at a very early period. The most important find was that made at Gungeria in the Bālāghāt District of the Central Provinces, which included 424 hammered copper implements and 102 silver laminæ, weighing 828 and 20 lbs. respectively. This has been described by Sir John Evans as the most important discovery of instruments of copper yet recorded in the Old World. Formerly the earliest date assigned to the prehistoric copper implements of India was *c.* 2000 B.C., based on arbitrary comparisons

[1] *L'Anthropologie*, i, p. 27. [2] Flinders Petrie, "Metals in Egypt": *Ancient Egypt*, i, 1915.

[3] King, *Sumer and Akkad*, p. 73; Hall and Woolley, *Al 'Ubaid*, pp. 34–5.

[4] Harold Peake, "The Copper Mountain of Magan": *Antiquity*, Dec. 1928, pp. 452–7.

[5] *Man*, Nov., 1921.

[6] Pumpelly, *Explorations in Turkestan*, 1904, p. 53. [7] *Cambridge Anc. Hist.*, i, p. 103.

with European examples. It was also believed that the prehistoric Indians were not acquainted with the art of manufacture and properties of bronze, and bearing in mind the fact that only seven specimens of prehistoric bronze, with a very irregular chemical composition, were known, it is not perhaps surprising that the existence of a Bronze Culture was denied.[1] However, the discovery of similar celts, but of superior workmanship, in the Indus Valley points to a much greater antiquity for the Northern specimens. The presence of copper at Mohenjo-daro and Harappā, even in the earliest stratum yet reached, indicates that copper must have come into use in India at a very early period, but no definite date can be assigned to it as yet. In the light of the various bronze objects that have been discovered at Mohenjo-daro, it is obvious that the Indus people were also well acquainted with the metallurgy and properties of bronze, and extended its use to the manufacture of tools, weapons, utensils, statuettes, jewellery, etc., but they failed to replace copper effectively for such purposes simply on account of the limited supply of tin. At Mohenjo-daro bronze objects have been found in the earliest stratum yet reached, and on the basis of the chronology adopted in this work, we may assume that bronze was known in the Indus Valley even earlier than 3000 B.C. This may be taken to imply the existence of commercial relations, direct or indirect, with some region where the invention of bronze took place—a region, probably, where deposits of copper and tin ores existed in close proximity to one another.

Bronze known by Indus people before 3000 B.C.

Sources of Copper.

Copper ore is unknown in Sind and the nearest deposits are situated in the countries bordering on the west of the Indus Valley. In Balūchistān, rich copper ore occurs at Shāh Bellaul and at Robāt, where large heaps of copper slag indicative of ancient smelting have been observed. Deposits of copper ore also occur in the Rās Kūh and Kojak Amrān range. Rich veins of the ore exist in the Shāh Maksūd Range in Afghānistān as well as at Kaleh Zeri (Kermān) and Anārek in Persia, at both of which places there is evidence of ancient working on an extensive scale. The nearest copper mines in India proper are those situated near Ajmer, in Sirohi, Mewār, and Jaipur States, notably those at Khetri and Singhāna, which have been worked from very early times. The presence of small quantities of sulphur and the absence of tin in the copper lumps point to the use of the sulphide ore, which abounds in these mines, for the extraction of copper. The presence of lead in some of the copper objects (1·58 and 3·28 per cent in two of the specimens analysed) is noteworthy, as it throws some light on the source of the metal. As copper ores associated with lead occur in Afghānistān and Balūchistān, it seems probable that some of the copper, at any rate, was obtained from these countries, but it should be added that copper ore associated with lead occurs also in Rājputāna and Hazāribāgh.[2]

Source of tin.

The source of the tin which is an ingredient of bronze is difficult to locate. Tin ore is scarce in India proper and unknown in Balūchistān. The only Indian deposits, worth mentioning, exist in the Hazāribāgh District, and appear to have been worked in ancient times. Tin occurs in the Kārā Dāgh District in North-Western Persia. Strabo mentions that tin was found in Drangiāna in the south-west of the modern Afghānistān, and ancient tin mines have been discovered by Van Baer in Khorāsān, between Astrābād and Shāh Rūd.[3] The rich deposits of cassiterite ore which occur in the Malay Peninsula and the neighbouring

[1] Vincent Smith, "On the Copper Age and Prehistoric Bronze Implements of India": *Indian Antiquary*, 1905, pp. 229 ff.; *ibid.*, 1907, pp. 53 ff.

[2] As some of the Indian copper ores (e.g. in Rājputāna and Singhbhum) contain nickel in appreciable quantities, the occurrence of nickel in the Mohenjo-daro specimens does not imply that the Indus people depended for their supply of copper on Oman or any other foreign source. Noteworthy, also, is the high proportion of arsenic in these specimens, which distinguishes the Indian from the Sumerian metal.

[3] Gowland, "Metals in Antiquity": *J.R.A.I.* vol. xlii, 1912, p. 252.

islands, that form the principal source of tin in the present age, do not appear to have been worked in early times. Moreover, a regular supply from this area, which involved a long and perilous sea voyage, must have been impossible in those remote ages. The possibility of a supply from Hazāribāgh must also be discounted, as the deposits are so meagre that they could barely have sufficed to meet local demands, and this assumption is amply justified by the scarcity of prehistoric bronze in the Gangetic Valley. Moreover, Hazāribāgh was isolated by deep forests from Northern India down to historic times. It is, therefore, more than probable that the sources of tin or bronze lay towards the North-West. It is a noteworthy fact that the ancient tin mines mentioned above were accessible from the busy and ancient highway that traversed North Persia and Western Afghānistān and afforded communication by way of the Bolān Pass between the Indus Valley and the Western World. As copper was extensively worked in these regions in ancient times, it is not unlikely that the discovery of the alloy of copper and tin, by the accidental smelting together of the ores of these metals, also took place somewhere in North Persia, and thence found its way to the Indus Valley. In this connection it is a significant fact that the daggers and knives discovered in the Indus Valley resemble some of the weapons found at Susa, Anau, and in the South-West Caspian area.

Typical analyses of the specimens of copper and bronze found at Mohenjo-daro are given below :—

CHEMICAL ANALYSES OF COPPER AND BRONZE FOUND AT MOHENJO-DARO
(*Analyses by Mohammad Sana Ullah*)

Serial Number.	Specimen.	Copper.	Tin.	Antimony.	Arsenic.	Iron.	Nickel.	Lead.	Sulphur.	Oxygen (by difference).	Remarks.
1.	Copper lump .	96·67	0·00	0·88	0·15	0·03	1·27	0·02	0·98	—	Unaltered core.
2.	Copper lump .	97·07	0·00	tr.	0·98	0·49	0·31	tr.	1·15	—	Unaltered core.
3.	Copper lump .	96·42	0·00	—	0·00	0·00	0·35	0·09	0·36	2·78	Partly oxidized.
4.	Copper lump .	92·49	0·37	tr.	1·30	1·51	1·06	tr.	2·26	1·01	Partly oxidized.
5.	Fragment of some implement.	95·80	0·00	0·72	0·74	0·12	0·25	1·58	0·61	0·18	Unaltered metal.
6.	Celt . . .	94·76	0·09	—	4·42	0·15	0·14	0·26	—	—	Unaltered and very hard metal.
7.	Copper chisel (?)	92·41	0·00	0·10	3·42	0·59	0·15	3·28	0·05	—	Unaltered portion.
8.	Bronze rod .	91·90	4·51	1·15	1·96	0·15	—	0·17	0·16	—	Unaltered core.
*9.	Bronze buttons .	88·05	8·22	2·60	tr.	0·29	tr.	0·00	0·84	—	Completely oxidized.
*10.	Bronze chisel .	86·22	12·38	0·35	—	0·35	0·00	0·70	—	—	Completely oxidized.
11.	Bronze slab .	82·71	13·21	0·33	1·17	0·42	0·56	0·11	0·00	1·49	Partly oxidized.
12.	Bronze chisel .	85·37	11·09	tr.	0·07	0·18	0·16	tr.	0·11	3·02	Partly oxidized.
13.	Bronze lump .	83·92	12·13	tr.	0·00	0·00	0·17	0·17	0·00	3·61	Metallic core, partly oxidized.

* *Note.*—Complete specimen, along with the adhering incrustations, was taken for analysis and the original composition of the alloy has been recalculated from the relative proportions of the metals found therein.

Neither copper ore nor any remains of a smelting furnace have so far been recovered at Mohenjo-daro, and it is highly probable, therefore, that the reduction of ore was carried out at the mines. Lumps of crude copper plano-convex in shape, 6 to 9 inches in diameter and 1 to 1½ inches thick in the centre, have been found, which were evidently produced by the smelting operation in a primitive furnace consisting simply of a concave depression in the ground. The crude metal was re-melted for refining in clay crucibles, which were broken up for the recovery of the purified metal. A fragment of such a crucible with the slag sticking to the edges, is illustrated on Pl. CXLII, 9. No specimen of pure tin or its ore has been found, so far, at Mohenjo-daro.

These analyses indicate the occurrence of four distinct varieties of copper and its alloys at Mohenjo-daro : (*a*) Crude copper, (*b*) refined copper, (*c*) copper-arsenic alloy, (*d*) copper-tin alloy or bronze.

(*a*) Specimens Nos. 1, 2, and 4 represent the crude product of the smelting furnace. They are too rich in sulphur to be worked up by hammering and are suitable only for casting heavy or plain objects.

(*b*) Specimens Nos. 3 and 5 are good examples of refined copper in general use. Specimen No. 3 is well suited for the raising of vessels of elaborate shapes on account of its remarkable purity and consequent ductility. The presence of over 3 per cent of foreign metals in No. 5 renders it suitable for obtaining sound castings in closed moulds. Such small amounts of arsenic and antimony will also impart appreciable hardness to copper although not comparable to that produced by tin. There is no doubt that these elements have not been added intentionally but were derived from the original copper ore with which they were associated.

Copper-arsenic alloy used for hardening.

(*c*) Specimens Nos. 6 and 7 represent a copper-arsenic alloy which is as hard as a low grade bronze. In these cases it is difficult to decide whether the arsenic was added intentionally, in the form of a flux, or was derived from an arsenic bearing copper ore. In this connection it is interesting to recall the occurrence of löllingite (a natural mineral composed of arsenic and iron) at Mohenjo-daro, and it may be questioned whether this mineral was intended for the preparation of this alloy.[1] It is a noteworthy fact that a similar alloy of copper and arsenic was also in use in Egypt, the composition of No. 6 being almost identical with that of a copper strip of the twelfth dynasty.[2] It is therefore quite possible that this alloy was obtained from the same source, both for the Indus Valley and Egypt. Petrie makes the interesting suggestion that arsenic was the earliest hardening element for copper in Egypt, and it may be that this alloy was employed for tools in the Indus Valley also, before the advent of bronze.

(*d*) Specimens Nos. 9 to 11 represent the various qualities of bronze in use. The percentage of tin is 4·51 in No. 8 ; 8·22 in No. 9 ; but in the last four, varies between 11·09 and 13·21. It is obvious that 11–13 per cent tin alloy was popular and had come into general use during the period under review, although lower grades were also employed to some extent. The preference of the high grade alloy well suited for sharp-edged tools, with a fairly regular proportion of tin, leaves hardly any doubt that the addition of the white metal was intentional and not the result of mere accident. It is obvious that this stage in metallurgy had been reached after prolonged experimentation and experience with copper and its alloys with arsenic and tin. These specimens are also contaminated with appreciable proportions of antimony and arsenic, which would add further to their hardness.

[1] On the subject of löllingite see p. 684 f.—[Ed.]

[2] Garland and Bannister, *Ancient Egyptian Metallurgy*, p. 66.

The proportion of lead in the bronzes is trifling, which shows that the Indus people had not discovered the valuable property of this metal in rendering the alloy more fusible and more fluid, that is, more suitable for casting. This partly accounts for the absence of bronze castings of any appreciable size at Mohenjo-daro. The Egyptians also remained ignorant of this fact until quite late, in the Saitic period.

ANALYSES OF COPPER AND BRONZE SPECIMENS MADE FOR THE SUMER COMMITTEE OF THE BRITISH ASSOCIATION BY PROF. C. H. DESCH, F.R.S.

Specimens from Mohenjo-daro: Season 1926–7

The specimens were completely oxidized, and contained sand and earthy matter mixed with the oxide and carbonate. Sulphur was usually present, but it is not certain whether this was in the metal originally or derived from the earth. A microscopical examination will be made to throw light on this point. The table is arranged to show the proportion of tin and nickel in the metallic part, excluding the sulphur, but the sulphur content is added in a separate column. The sulphur figures refer to the crude oxidized material. The tin and nickel figures are calculated as if the remaining metal were only copper, except where other metals were detected. In most specimens other metals were certainly absent.

	Tin.	Nickel.	Lead.	Sulphur.
SD 1405 . . .	—	0·17	0·36	6·78
SD 1932 . . .	—	9·38	tr.	1·73
L 3767 . . .	—	3·34	0·30	7·77
SD 2683 (A) . .	—	tr.	present	—
SD 2683 (B) . .	—	—	—	—
SD 2683 (C) . .	—	tr.	—	2·63
L 111 x . .	—	1·04	—	2·40
HR 1152 . . .	—	0·39	—	0·32
E 602 . . .	14·4	tr.	—	—
HR 1472 . . .	—	1·49	—	0·23
VS 1572 . . .	19·0	0·23	—	0·43
VS 1416 . . .	—	0·09	—	0·28
DK 542 . . .	—	0·30	—	0·34
DK 1679 . . .	—	tr.	present not	0·05
DK 2155 . . .	—	0·53	estimated	0·03

Balance copper.

Specimens from Mohenjo-daro: Season 1927–8.[1] As before, the tin and nickel have been calculated back to the metallic contents, other metals having been determined to be absent :—

No.	Mark.	Tin.	Nickel.
1	DK 3479	—	—
2	„ 4585	10·2	—
3	„ 4378	—	—
4	„ 3833	—	—
5	„ 4568	10·3	tr.

[1] It is due to the courtesy of Mr. E. Mackay that I am able to include the analyses of these specimens in the present work.—[ED.]

No.	Mark.	Tin.	Nickel.
6	DK 4588	14·6	—
7	„ 3735	—	tr.
8	„ 4035	—	faint tr.
9	„ 4005	—	faint tr.
10	„ 3731	—	0·22
11	„ 3939	—	faint tr.
12	„ 3992	—	tr.
13	„ 3955	—	tr.
14	„ 3914	—	—
15	„ 3956888	—	tr.
16	„ 3935	—	tr.
17	„ 3849	—	tr.
18	„ 3843	—	faint tr. Much lead.
19	„ 3756	—	0·68
20	„ 3748	—	tr.
21	„ 4128	—	0·86
22	„ 3846	—	faint tr.
23	„ 4185	—	tr.
24	„ 4173	—	0·51
25	„ 4059	—	0·15
26	„ 4087	—	0·26
27	„ 4068	10·7	tr.
28	„ 4041	—	tr.
29	„ 3648	—	—
30	„ 3760	(Lead, containing 0·007% silver)	
31	„ 3612	—	tr.
32	„ 3630	11·6	tr.
33	„ 3611	—	0·14
34	„ 3712	—	0·24
35	„ 4599	—	0·04
36	„ 4600	5·6	0·21
37	„ 4396	—	0·05
38	„ 4400	—	0·07
39	„ 4361	19·1	tr.
40	„ 4466	(Lead, containing 0·036% silver)	
41	„ 4451	—	—
42	„ 4303	—	faint tr.
43	„ 4431	—	—
44	„ 4565	—	tr.
45	„ 4586	—	faint tr.
46	„ 4330	—	tr.
47	„ 4384	—	—
48	„ 4260	—	—
49	L 1208	(Lead, containing 0·02% silver)	
50	L 1226	(Lead, containing 0·008% silver)	
51	DK 3566	—	0·81
52	„ 4642	—	—

Balance, copper except where marked as lead specimens.[1]

[1] All these specimens come from Late Period levels.

Specimens obtained by Sir Aurel Stein in Balūchistān. Received Sept., 1928.

1. Copper from bracelet. Jiwanri iii, xvi f. Too small for analysis.
2. „ spear-head. sh.T. vii. 12d. „ „
3. Bronze. Zangiān. i, v. Tin, 23·1; nickel, faint trace.
4. Disk. Shāhī-tump. xiv. „ 5·3; „ trace.
5. „ „ ii. „ 6·0; „ nil.
6. Vessel from Gatti. „ 27·0; „ nil.

Ditto, received Oct., 1928.

		Tin.	Nickel.
1.	Plate. Dwelling, iv, *c*	nil	1·77
2.	Beads. Surface of Mound, Dasht	21·4	nil
3.	Rod. Tāke-dap	18·0	nil
4.	Cup. Gate-dap, Kolwa	23·9	nil
5.	Fragment from Tumpak, Makrān	6·4	tr.
6.	Fragment from Shāhī-tump	6·2	nil
7.	Spiral wire from Mehī, Mashkai	11·4	faint tr.
8.	Plates found with mirror, ii, 2	nil	tr.
9.	Bowl from Mehī-damb, Mashkai	nil	tr.
10.	Plates, from surface, Mashkai.	24·4	nil
11.	Plates, from Bit-damb, Bāghwāna	32·5	tr.
12.	Curved Plate. Siāh-damb	11·7	nil
13.	Fragments from surface, Kolwa	19·3	nil
14.	Rod from Segak mound, Kolwa	8·7	tr.

Nos. 5 and 14 contained traces of lead.

Of the above specimens, those from Jīwanrī, Zangiān, Gatti, and Tāke-dap belong to the historic period; those from Shāhī-tump, Mehī, Siāh-damb, and the Segak mound to the prehistoric period. The age of the other specimens is uncertain, but it is seems probable that those which exhibit an exceptionally high percentage of tin are posterior to the prehistoric age. It should be noted that very little nickel occurs in the copper from Balūchistān.—[Ed.]

Part II

TECHNIQUE AND DESCRIPTION OF METAL VESSELS, TOOLS, IMPLEMENTS, AND OTHER OBJECTS

Technique. It is not easy to determine the technique employed in the making of many of these utensils. It would be a simple matter to raise all the copper vessels from sheet metal, as their shapes are simple. But in the case of the bronze vessels there are two methods that could have been employed: Firstly, beating them out of sheet bronze which, however, would call for constant annealling to prevent the metal from cracking; or, secondly, the process that is called *cire perdue*. But the latter process is exceedingly difficult for large and thin castings owing to the risk of flaws and crevices that would render the vessel made in this way non-watertight. The varying thickness of the metal of some of the bronze vessels certainly suggests that the *cire perdue* process was used; but, on the other hand, it is possible that this inequality may be due to corrosion—the majority of the bronze pieces and some of the copper pieces could not be chemically cleaned owing to their very bad condition. I am

inclined myself to the opinion that some of these bronze vessels were raised from sheet metal which, being unrolled, would in the first place not be of equal thickness throughout.[1] The fact that a second piece of metal was used to form the base of the utensil shown in Pl. CXLI, 6, I think, corroborates this view, unless we are to suppose that this vessel when cast had a faulty base and had subsequently to be repaired.[2]

Bronze. The use of bronze instead of copper for utensils indicates a great advance in metal working. Copper is an ideal material for making household utensils owing to the metal being so ductile; but unless it is fairly thick it is apt to bend and dent, especially if the temper produced by hammering is destroyed by heat, as, for instance, when vessels are used for cooking purposes. Bronze has the disadvantage of being considerably less ductile, but a finished vessel of this material is considerably stronger and less liable to damage.[3]

Counterparts in pottery. On reference to the pottery plates it will be seen that many of these utensils have their counterpart in pottery. For instance, Nos. 7 and 18 in Pl. CXL are obviously of the same type as the pottery jar illustrated in Pl. LXXXVI, 22. The two silver vases seen in Pl. CXL, 1 and 2, are of exactly the same shape as Nos. 55–8 in Pl. LXXXI. And other comparisons can easily be made.

Ribbed ware. I have already pointed out in the chapter on the pottery that ribbed ware is very rarely found at Mohenjo-daro. It is, therefore, satisfactory to have among our metal vessels one type shown in Pl. CXL, 18. Ribbing of this nature was, however, not primarily intended to strengthen the jar; it is a copy of the very old method of making a pottery vessel in two portions which were subsequently fitted together before firing, the rib being caused by the projecting edge of the lower portion being lapped over the upper portion of the jar. Only those metal vessels which were difficult to shape were made in this way, and the vessel under discussion, which is obviously a copy of the older pottery pattern, was without doubt shaped from a single sheet of metal.

Metal vessels rare. The reason of the scarcity of metal utensils at Mohenjo-daro can only be that, when the city was deserted, the inhabitants had sufficient time to remove their most valued possessions. Even at the present day copper vessels are of considerable value in the East and are bought by weight rather than by size. If a vessel of this metal be accidentally crushed out of shape, it can easily be restored by a coppersmith. It is only when it is badly holed that it must be replaced by a new one; and then the weight of the metal in the old vessel is credited towards the cost of the new one.

Casting. Nos. 4 and 5 in Pl. CXL prove to us that the art of casting bronze was a well-established industry at Mohenjo-daro. Both the dishes and their covers are cleanly made; so much so, that they must have been either carefully rubbed down or trued up on a lathe. No lathe-marks are visible, but these could have been removed by subsequent honing and polishing. The fact that the handles of the covers were made separately from the lids themselves is difficult of explanation, for the two could easily have been cast together in a not too complicated mould. In describing No. 5, I have mentioned that the handle was secured to the cover not only by a rivet, but also by pouring molten metal around the base of the rivet for additional security; this process is known as "running on", and is one which requires skill to perform.

[1] Mr. Mackay's view is not shared by Mr. Sana Ullah, who emphasizes the difficulty of raising such vessels from sheet metal and quotes Garland and Bannister, op. cit., p. 65.—[Ed.]

[2] Casting by the *cire perdue* process was, however, practised in Egypt as early as, if not before, the Third Dynasty. See Garland and Bannister, *Ancient Egyptian Metallurgy*, p. 35. It has not yet been definitely decided whether the same process was used in early Sumer. See Hall and Woolley, *Al 'Ubaid*, pp. 34–5

[3] Possibly, as Childe suggests, tin was added to copper not to harden it, but to lower the melting point. *Dawn of European Civilization*, p. 33.

Bases. As these utensils were used on floors of hard brick or mud, the majority have flat or semi-flat bases. Those with rounded bottoms were probably kept either on wooden stands, which have perished, or on the circular pottery rings of which we find so many at Mohenjo-daro.

Rims. It is curious that no attempt should have been made to strengthen the rims of these metal vessels by turning the metal down a little all the way round. The rim of a metal jar or dish is always its weakest part and likely to suffer damage, unless it be properly thickened. Some slight advance towards this method is shown, however, by the flaring of the rims, which undoubtedly produced a certain amount of stiffness. Why the process should not have been carried further, it is difficult to say, as a turned down or beaded rim is ornamental as well as protective.

Copper and bronze found together. We have sufficient proof that copper and bronze were in use at the same time from various groups of vessels that were found together.

Group 1 consists of three vessels (C 1978), two of which are of copper and the third of bronze (Pl. CXL, 11, 14, and 17). With these were found discarded tools, some broken and bent, made in bronze as well as in copper. The depth at which they were found (2 feet) would date them to the Late Period.

Group 2 (E 2044), shown in Pl. CXL, 4, 5, 9, and 18, consists of two bronze vessels and two of copper, also belonging to the Late Period.

Group 3 (HR 4212*a*) comprises two silver jars and one of bronze, shown in Pl. CXL, 2 and 3, and Pl. CXLI, 13. With these were associated a number of copper and bronze implements of various kinds, described further on in this chapter.

Description of Copper, Bronze, and Silver Utensils

Copper and Bronze Vessels

Plate CXLI.

Detailed descriptions. No. 1 (C 100–1). See also Pl. CXL, 6. Bronze vessel with slightly projecting flat base. Badly bent and with pieces missing. Plain rim with edge 0·09 inch thick. The metal thins towards the base to 0·04 inch in thickness. Despite corrosion, hammer-marks can still be seen in places. Height, 5·75 inches. Level, 5 feet below surface. Room 9, Block 12, Section C, DK Area.

No. 2 (C 100–1). See also Pl. CXL, 20. Large well-made bronze jar; badly broken and pieces missing. Small flat base that appears to have been lapped on. Plain edge, 0·18 inch thick. The metal of this jar is of unequal thickness, which suggests that it may have been cast, though unequal corrosion might possibly account for variation in thickness. Height, 10·5 inches. Level, 5 feet below surface. Room 9, Block 12, Section C, DK Area.

No. 3 (C 95). See also Pl. CXL, 7. Base missing. Shows traces of having been hammered. Thickness of metal fairly equal throughout, and averages 0·04 inch. Plain bent-over rim. Material copper. Height, 4 inches. Level, 4 feet below surface. Room 9, Block 12, Section C, DK Area.

No. 4 (C 1978). See also Pl. CXL, 14. Base and other parts of jar missing. Plain rim measuring 4·6 inches across. Of copper of unequal thickness, varying from 0·15 inch at rim down to 0·05 inch towards the base. Height, 9 inches. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area. In this jar were found several copper implements which are illustrated in Pl. CXXXV, 2; Pl. CXXXVI, 1 and 4; and Pl. CXXXIX, 11. These are in a good state of preservation owing to having been protected in a measure from the soil.

Copper implements.

Censer. No. 5 (E 2044). This object appears to be the stem and base of a censer similar in shape to the offering-stands of pottery, from which the pan has disappeared. The copper base, which is incomplete and broken off the stem, is decorated with a fluted pattern not unlike that on the pan or base illustrated in Pl. LXXXVII, 3. The flutings are hollow on the inside; and the rim is bent over slightly and has a raw edge decorated with three rows of indented markings which can just be seen in the illustration.

Fluting. The stem was fluted, horizontally and fairly regularly, by means of hammer-work, whose marks still show in places; it was once a single piece of metal with the base. The knob at the top of the stem is a solid bronze casting and very heavy. That it is of bronze is proved by its being considerably lighter in colour than the stem and base. A circular mark upon it suggests that it was given a final finish on a lathe. There would seem to be also traces here of a rivet, by which the pan was affixed to the stem. Estimated height, 6·65 inches. Diameter of base, 6·75 inches. Level, 4 feet below surface. This object was found in the large copper vessel illustrated in the same plate (No. 12). Room 1, House I, M, Trench E, DK Area.

Base lapped on. No. 6 (E 2045). See also Pl. CXL, 12. Badly broken and bent. Has a plain flared rim. The projecting base, as the photograph shows, was roughly lapped on, the turned-over edge being very unequal in places. The metal of this vessel is unequal in thickness; half-way down it is 0·15 inch thick and at the rim 0·1 inch. This may be due to unequal thickness in the sheet from which the vessel was made, or perhaps to corrosion. Material, bronze. Height, 8 inches. Level, 4 feet below surface. Room 1, House I, Trench E (M), DK Area.

No. 7 (HR 5627) is a piece of copper shaped like a mussel-shell. It has a hole 0·08 inch in diameter pierced through it near one edge, and this edge is thicker and more raised than the opposite one. This object may have been used as a dipper and hung up by a cord when not in use; or it may have been affixed to a handle, though one would expect two holes if the object had been riveted to anything. It measures 3·75 inches long by 2 inches wide. The thickness of the metal is 0·1 inch. Level, 4 feet below surface. Area to east of Structure XXXIX, Block 5, HR Area.

A similar object (HR 3941), which is not illustrated, is also the shape of a mussel-shell. It measures 3·2 inches long and 2·03 inches wide by 0·05 inch thick. There is also a hole 0·2 inch in diameter near one edge. Level, 2 feet below surface. Both these objects were purposely made this special shape; they are not pieces of metal cut haphazard out of copper sheet. Room 9, House VIII, Block 2, HR Area.[1]

Handle. No. 8 (HR 5725) is a twisted piece of copper which was probably the handle of some utensil. Its present length is 3·3 inches. The portion to be gripped has been bent into a rough tube with slightly overlapping edges. The rest is broken and incomplete. Level, 6 ft. 4 in. below surface. Room 40, House LV, Block 7, HR Area.

No. 9 (E 188). See also Pl. CXL, 8. Small vase, wide mouthed and with plain rim. The base is heavy compared with the thin sides. Thickness of metal at rim 0·15 inch, at middle height 0·09 inch, at base 0·2 inch. Its unequal thickness may be due to corrosion. A curious sunken band around the base of the jar measures 0·8 inch wide and 0·2 inch in depth. This vessel has the colour of pure copper, though it is made of bronze. Height, 4 inches. Level, 2 ft. 6 in. below surface. Trench E, DK Area.

No. 10 (C 100–1). See also Pl. CXL, 13. Bronze bowl of very thick metal, which seems to have been cast. Plain rim 0·34 inch wide, rather roughly finished and uneven. Rounded base. Diameter 12·75 inches. Height, 4·4 inches. Level, 5 feet below surface. Room 9, Block 12, Section C, DK Area.

[1] A number of these objects of exactly the same shape have since been found.

No. 11 (C 1978). See also Pl. CXL, 14. This is another illustration of Pl. CXLI, 4, to show its contents when found. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

Ribbing. No. 12 (E 2044). See also Pl. CXL, 9 and 18. Both vessel and cover are of copper. The thickness of the metal at the level of the beading is 0·15 inch, and at the base 0·1 inch. The rim of the vessel is plain and lapped over slightly to stiffen it. The surface is too corroded to show the technique used in making this jar, but undulations of the surface suggest hammer-work. This vessel was not made in two pieces and joined together at the ribbing, as one at first would suspect; the whole was made from one sheet of metal. The ribbing was formed from the inside by beating the metal on a round-edged anvil. The cover was not made to fit the vessel, as is seen in Pl. CXL, 9. It was found adhering to the top of the jar, and it has not been found possible to remove it.[1] **Contents.** This vessel contained the fine girdle of carnelian beads, and bronze and other gold and silver ornaments illustrated in Pl. CLI, *b*, and also the incomplete metal censer shown in Pl. CXLI, 5. Height, including cover, 12 inches Level, 4 feet below surface. Found in the north-western corner of Room 1, House I, Trench E (M), in the DK Area. (See Pl. LXV.)

No. 13 (HR 4212*a*). Bronze vase of graceful form. Small flat base and plain flared rim. Broken and repaired. Appears to have been cast. Height, 7 inches. Level, 6 feet below surface. This vessel was found with the two silver jars illustrated in Pl. CXL, 2 and 3, in Room 8, House VIII, Block 2, HR Area.

Plate CXLII.

Cast bronze. No. 1 (E 2044). See also Pl. CXL, 4. Dish and cover of cast bronze. The dish is of very heavy metal, well finished and with a smooth surface. The cover fits very closely to the dish and has a slight projection on the inside, made by thinning the edge, to prevent its sliding off. The two fit so very closely together that there is practically no play at all. The handle is a separate piece riveted to the top of the cover, as can be plainly seen on the inside. There are indications, too, on the inner surface of the cover that it was cast in a sand mould. The dish measures 6·55 inches in diameter and 0·95 inch high, and the cover is slightly more in diameter. The two together stand 2·6 inches high. Judging from the very careful way in which the cover was made to fit the dish, it is possible that they were made for some commodity of value, perhaps a scented fat which was volatile. Level, 4 feet below surface. Room 1, House I, Trench E (M), DK Area.

Nos. 2 and 3 (E 2044). See also Pl. CXL, 5. A dish and cover similar to the last, but not so well preserved. They are of slightly larger size, the dish measuring 7·4 inches in diameter. The bobbin-like handle was riveted on, and a patch of rough metal that now partly hides the rivet suggests that molten metal was run over it to help secure it. Level, 4 feet below surface. Bronze. Room 1, House I, Trench E (M), DK Area.

No. 4 (E 190). See also Pl. CXL, 19. Small vessel of beaten copper. Base projects a little and is slightly concave. Hole in centre of base, 0·18 inch in diameter. Rim plain, slightly flared and 0·07 inch thick. Height, 2·5 inches. Level, 2 ft. 6 in. below surface. Room 6, House II, Trench E (M), DK Area.

No. 5 (C 1978). See also Pl. CXL, 17. Bronze bowl of same type as No. 3, but smaller. 3·75 inches in diameter and 0·5 inch high. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

No. 6 (E 190). See also Pl. CXL, 16. Bronze flask, 3·05 inches high. Evidently

[1] Such dishes were commonly used to cover metal vessels.

cast. Surface not particularly well finished, but the working of the flask may not have been completed. Very thick, solid metal. Level, 2 ft. 6 in. below surface. Chamber 6, House II, Trench E (M), DK Area.

Punch-markings. No. 7 (E 2044). Jar-cover beaten from very thin copper sheet, 0·02 inch thick. In order, apparently, to stiffen the edge, this cover was stamped all round inside the edge with a row of punch-marks, which, however, do not show through the metal. At the top of the cover the metal has been raised up to form a projection, 0·47 inch in diameter and 0·22 inch high. This could only have served as a handle, especially if it was once capped, as appears likely. Passing through this projection there are the remains of a strip of copper, 0·21 inch wide, which was bent into a loop; the ends after being passed through the projection were twisted back on either side. Diameter, 2·57 inches. Level, 4 feet below surface. Room 1, House I, Trench E (M), DK Area.

No. 8 (E 2044). Bronze cover. Similar in shape and make to Nos. 1 and 2 in the same plate. Diameter, 4·9 inches. Height, 1·1 inches. Level, 4 feet below surface. Room 1, House I, Trench E (M), DK Area.

No. 9 (No. ?). Possibly portion of clay crucible, with slag sticking to its sides.

No. 10 (DK 1621). See also Pl. CXL, 10. Very thick copper pan, measuring 11·3 inches across the rim, which is plain, and 1·42 inches high. Thickness of metal at rim 0·15 inch. Level, 1 foot below surface. Room 25, Block 2, Section C, DK Area.

No. 12 (E 189). Simple copper bowl with plain edge, 0·1 inch thick. Height, 1·75 inches. Diameter, 4·75 inches. Level, 3 ft. 6 in. below surface. Room 6, House II, Trench E (M), DK Area.

Plate CXL.

No. 11 (C1978). Copper pan, half of which is missing. Shallow and with flat base. Diameter, 8·7 inches. Height, 1·1 inches. Level, 2 feet below surface.

Silver Vessels

Plate CXL.

Silver vase. No. 1 (DK 1341). See also Pl. CXLVIII, *b*. Silver vase and cover measuring 8·25 inches high. Cast. Level, 3 feet below surface. Room 2, Block 16, Section C, DK Area.

Jewellery contents. This fine vase was found to contain the gold and silver jewellery illustrated in Pl. CXLVIII, *a*, which are described in Chapter XXVI devoted to "Personal Ornaments". In order to extract this jewellery, it was found necessary to saw away part of the cover which owing to corrosion had become firmly fixed to the vase.

No. 2 (HR 4212*a*). Small silver vase made by casting. Height, 2·7 inches. Level, 6 feet below surface.

No. 3 (HR 4212*a*). Vase raised from a sheet of silver (?). Flat base and of simple make. Height, 3·8 inches. Cover 1·85 inches high. Level, 6 feet below surface.

Associated vessels. Both these two last vases contained a quantity of gold ornaments and stone beads, a great part of the former being merely scrap metal. This jewellery is illustrated in Pls. CXLIX, CL, and CLI, *a*, and is described in the chapter on "Personal Ornaments". The larger silver vase (No. 3) was found with its cover upside down, and considerable difficulty was experienced in removing the cover to get at the contents of the vase. With the two vases there was also found the bronze vessel pictured in Pl. CXLI, 13, and associated with the three were a number of implements illustrated in Pl. CXXXV, 5, 12, and 13; Pl. CXXXVII, 1, 4, 8, 9, 10, and 12; and Pl. CXXXIX, 6, 7, and 8. From Room 8, House VIII, Block 2, HR Area.

Blade-axes

Blade-axes.

The blade-axes illustrated in Pls. CXXXVIII and CXXXIX could have been used either in war or for ordinary purposes. For war and hunting they were probably set in a split handle, at right angles to it and secured by lashings of raw-hide. For carpentry they may have been hafted differently. It is possible that the implement shown in Pl. CXXXIX, 5, was used as an adze, for it has a true chisel-edge, whereas the cutting edges of the other implements of this group are sloped both sides, the slope being gradual and flowing so that there is no abruptness.

In every case these implements are of substantial make and there was no skimping of metal. Few of the butts have the corners more than slightly rounded off. In one weapon (Pl. CXXXIX, 5), both ends of the tool are sharp-edged, and three blade-axes (Pl. CXXXVIII, 1, 2, and 6) have blunt edges at the butt, which suggests that this end also could be sharpened and utilized if required.

Copper more common than bronze.

As would be expected at this early period, copper is more commonly used for making blade-axes than is bronze, there being only three made in the latter material, not including a non-illustrated specimen (C 1978), which has all the appearance of being of bronze.

Mode of manufacture.

It is probable that these simple axes were first cast in open moulds and then hammered to give them the requisite hardness. There are ridges on the edges of several copper axes from the famous Gungeria hoard of 424 copper implements found in the Central Provinces, some of which are in the British Museum, which suggest that they were cast in a closed mould.[1] Copper is, however, difficult to cast in this manner, and there seems to me but little advantage in doing so with weapons of simple shape, except that the resulting castings would perhaps be cleaner. We do not, however know, the age of the Gungeria implements ; they may be of later date than those of Mohenjo-daro and a more advanced technique may have been employed in their manufacture.

Finish.

The absence of hammer-marks on all our examples except one suggests that they were carefully rubbed down after being hammered. Their straight cut sides and butts and only slightly rounded angles indicate some such treatment; for these features, which were probably also present in the mould, would have been destroyed in the process of hammering.

The bronze blade-axes would have required very much the same treatment, though cleaner castings could be obtained with this alloy and, therefore, not so much hammering would be required to harden them. Their tin content served this latter purpose.

Thickness.

The greatest thickness of the blade-axes of Mohenjo-daro is at about two-thirds down them, which gave weight at that part of the blade where it was most needed. It is uncertain whether the blades were cast with this special thickness here ; it is more probable that the castings were originally flat slabs of more or less equal thickness throughout, and that when they were beaten to harden them little was done to the centre of the implement, but more attention was paid to the edges which were thinned out. The blade-axe in Pl. CXXXVIII, 6, distinctly shows that the hammering was started from the centre lightly and that the blows became more pronounced as the edges were approached; the latter have been beaten comparatively thin.

Comparisons.

In certain respects the short type of axe is not unlike some of the copper axes found in the Bijnor district and now in the Lucknow Museum.[2] And certain of the Gungeria implements resemble those of Mohenjo-daro, while others are entirely different in type. Some of the blade-axes of Mohenjo-daro have an incipient shoulder (Pl. CXXXVIII, 3 and 6,

[1] V. Smith, "The Copper Age and Prehistoric Implements of India" in *The Indian Antiquary*, vol. xxxiv, p. 238.

[2] *Ibid.*, pl. i, fig. 12.

and Pl. CXXXIX, 3 and 4), a feature which is also found among the Bijnor and the Gungeria axes, but is far more pronounced. This feature, however, is not confined to Indian weapons, for it is found in Hungary and Western Europe in both the Copper and Bronze Ages.

The blade-axes of about 3100 B.C. from Kish have rounded or semi-rounded tops and almost straight edges.[1] They all belong to a long and narrow type. But some very early blade-axes from Susa,[2] with but slightly splayed edges and straight sides and butts, approach very closely to the Mohenjo-daro blades of Type 1. This is perhaps what we should expect, for numerous connections between ancient Elam and the Indus Valley civilization are now known to us. The short and wide blades of Type 2, some of which have distinct shoulders, are not exactly paralleled in either Sumer or Elam, though very similar weapons are known in the Copper Age of Europe.[3]

For easy reference the axes found at Mohenjo-daro are grouped into two types, as below :

Types.

Type 1. Long and narrow.
Type 2. Short and broad.

The first type is perhaps the more common, but owing to their more substantial make the blade-axes of the second type are invariably in a better state of preservation.

Type 1. Long and Narrow Axes (Pls. CXXXVIII and CXXXIX)

Plate CXXXIX.

Descriptions.

No. 1 (VS 1450). See also Pl. CXXXVIII, 1. 8·9 inches long by 0·24 inch thick. Edges at both top and bottom. Bottom edge rounded and 2·3 inches wide. Copper. Level, 5 feet below surface. Room 11, House XXX, Block 5, VS Area.

No. 5 (L 383). 7·15 inches long by 0·23 inch thick. Width of chisel-like edge 2·8 inches. Butt square with sharp edge. Sides cut square with slightly rounded edges. Copper. Level, 1 foot below surface. Room 104, Block 8, L Area.

No. 7 (HR 4212). Portion of a long blade-axe. Part of edge missing, but width is estimated at 2·38 inches. Edge sharp and gradually sloped both sides. Sides cut square. Bronze. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

No. 8 (HR 4212). Portion of a long blade-axe, 0·22 inch thick. Edge straight (a rare feature) with a sharp slope on either side; 1·9 inches wide. Appears to be bronze. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

No. 10 (C 1978). Fragment of blade-axe, 2·5 inches wide and 0·2 inch thick. Both sides of cutting edge slope abruptly. Bronze. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

Pl. CXXXVIII.

Wide butt.

No. 7 (HR 6056). 4·82 inches long by 0·2 inch thick. Sides and butt cut square. This blade is unusual in that the butt end, which is 1·32 inches wide, is of greater width than the edge. Both sides of edge slope. Copper. Level, 6 feet below surface. Room 87, House IX, Block 2, HR Area.

Non-Illustrated Specimens of this Type.

C 1978. Very roughly made blade, 5·8 inches long by 0·21 inch thick. Blunt rounded

[1] Mackay, *Sumerian Palace and "A" Cemetery at Kish*, Field Museum, Chicago, pt. ii, pl. lxi.

[2] *Mém. Dél. en Perse*, vol. xiii, pl. i, figs. 11 and 12. See also a specimen from Nagada, Egypt, dating from the Second Predynastic Culture. Childe, *The Most Ancient East*, p. 89, fig. 32.

[3] Petrie, *Tools and Weapons*, pl. i, figs. 26–8.

edge, 1·8 inches wide. Very battered and bent, and seems to have been used for some other purpose. Appears to be bronze. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

Type 2. Short Broad Axes (Pls. CXXXVIII and CXXXIX)

No. 2 (VS 1450). See also Pl. CXXXVIII, 5. 6·95 inches long and 0·33 inch thick. Width at edge 3·55 inches. Edge rather blunt, very rounded, and has very slight suggestion of splay. Butt slightly rounded. Copper. Level, 5 feet below surface. Room 11, House XXX, Block 5, VS Area.

No. 3 (VS 1450). 7·5 inches long and 0·37 inch thick. Edge 4·2 inches wide. Butt, 2·9 inches wide. Sides slightly concave. Edge very rounded and slightly splayed, sharp, and gradually sloped on both sides. Butt cut square and flat. A very handsome implement. Copper. Level, 5 feet below surface. Room 11, House XXX, Block 5, VS Area.

No. 4 (VS 1450). See also Pl. CXXXVIII, 3. 5·95 inches long and 0·39 inch thick. Edge very sharp, rounded, sloped on both sides, 3·5 inches wide. Distinct shoulders present. Sides and butt cut square. Copper. Level, 5 feet below surface. Room 11, House XXX, Block 5, VS Area.

Bronze.

No. 6 (HR 4212). Portion of blade-axe, 0·35 inch thick. Edge is slightly splayed, 3·7 inches wide, and steeply sloped on both sides. The edge is badly corroded. Bronze. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

No. 9 (VS 3185). A broken casting, 6·2 inches long and 0·45 inch thick. Both the projecting edges in the lower portion of the illustration are sharply sloped on both sides, and once formed the edges of a large blade-axe. Copper. Level, 10 feet below surface. It is possible that the casting was found to contain a flaw and in consequence it was broken up for remelting. Room 10, House XXXIV, VS Area.

Pl. CXXXVIII.

No. 2 (VS 1450). 8·25 inches long and 0·35 inch thick. Width at edge, 4·03 inches. Edge blunt and gradually sloped on both sides. The square butt also has a blunt edge. Sides cut square with slightly rounded edges. Copper. Level, 5 feet below surface. Room 11, House XXX, Block 5, VS Area.

Hammer-marks.

No. 6 (VS 1450). 6·25 inches long and 0·3 inch thick. Rounded edge sharply sloped on both sides. Butt end is also fined to a blunt edge. This implement was hammered from the centre towards the edges, which are all slightly thinned. Copper. Level, 5 feet below surface. Room 11, House XXX, Block 5, VS Area.

Specimens of same type not illustrated.

VS 1450. 8·45 inches long and 0·4 inch thick. Edge sharply rounded and slightly splayed. Butt cut straight with corners carefully rounded off, 2·8 inches wide. A fine heavy implement, very carefully made. Sharp edge sloped on both sides, 4·25 inches wide. Incipient shoulders. Copper. Level, 5 feet below surface. Weight, 2 lb. 1 oz. Room 11, House XXX, Block 5, VS Area.

C 1978. 5·75 inches long and 0·35 inch thick. Abruptly rounded edge with double slope, 3·2 inches wide. Butt, 2·2 inches wide, cut square with corners slightly rounded. Sides cut square with distinct shoulders near edge. Copper. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

HR 4212*a*. 6·05 inches long and 0·28 inch thick. Edge rounded, slightly splayed,

and 2·25 inches wide. Butt cut square with sharp corners and 1·7 inches wide. Edge sharp and sloped both sides. Appears to be bronze. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

C 1978. 3·25 inches long and 0·22 inch thick. Slightly rounded edge, sharp and sloped both sides, 2·05 inches wide. Butt, 1·6 inches wide. Sides and butt cut square. Copper. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

Spear and Lance-heads (Pls. CXXXV and CXXXVI)

It is with some hesitation that the weapons about to be described are called spear-heads. The possibility of their being knives used for a special purpose, such as flaying, is precluded, I think, by the total absence of rivet holes by which they could be secured to a handle.[1] It is unfortunate that no traces now remain of the wooden handles or shafts in which these heads were once fixed. Their complete disappearance proves them to have been of wood, and the unkindly soil of Mohenjo-daro accounts for their non-preservation.

Unsubstantial make. These spear and lance-heads are peculiar for the width and thinness of their blades. Some, indeed, are so thin that, unless they were reinforced in some way, they would have doubled up with even moderate pressure. It seems likely, therefore, that these blades were strengthened down their axes. Wood was most likely employed for this purpose ; but how it was fastened to the blade is not clear, seeing that there are no rivet holes. It is probable that the shafts in which these blades were fitted were of a hard stiff wood, and that the portion that took the blade was sawn down longitudinally instead of split, so that the sides of the bifurcation might grip snugly along the blade, acting as a kind of mid-rib on either side. A wood such as bamboo with its tough exterior would serve this purpose admirably. Whether a cement was also used is not known, but shellac, it should be remembered, was probably a product of Sind in ancient days as now.

The thinness of these spear-heads and their being made of copper seem strange in view of the weight and heavy nature of the blade-axes. True, the latter implements require weight to be effectual, but this is also required in spear and especially in lance-heads. Seeing that metal was not spared in the manufacture of the blade-axes, we must conclude that it was not for reasons of economy that so little metal was used in the making of the spear-heads.

I venture to suggest that these large thin spear-blades were not made by the inhabitants of Mohenjo-daro, but that they were trophies captured from a people of inferior civilization. It is difficult to believe that the people who built Mohenjo-daro used such inferior weapons ; on the other hand, there may have been a less civilized people living in Sind at the same time, such as the Bhils, Gonds, and other tribes who inhabit India at the present day. It is such people as these who would have made such primitive spear-heads ; their poor resources would have compelled them to stint the metal in them as much as possible.[2] The habit, even at the present day, of keeping weapons of strange make as curiosities might also have held among the people of the Indus Valley civilization.

Metal rods. The blades seem to have been made from a rod of metal but little thicker than the tangs. There does not seem any possibility that they were cast in their present shape, although the rods from which they were made were probably cast. The greatest thickness is at or close to the tang, and the hammering to shape seems to have commenced from about

[1] The flaying knives, however, from Egypt which are illustrated by Flinders Petrie, *Tools and Weapons*, pls. xxiii, K, 1, and xxxi, 2, etc., are without any rivet holes.—[Ed.]

[2] The fact, however, that these weapons have been recovered from all parts of the site and from various levels, and that similar weapons have been found at Harappā, necessarily militates against Mr. Mackay's hypothesis.—[Ed.]

this point. A little extra thickness was allowed for on the axis of the blade, but it gradually fines down towards the point. There is no attempt at a mid-rib.

Use of hone. Judging from a slight irregularity (concavity) in the edges of some of the blades, it is probable that they were sometimes sharpened up with a hone to remove burring and notches. But apart from rectifying actual damage, these blades owing to their thinness would require but little attention in the way of sharpening.

African types. In general shape these spear-heads resemble those used in parts of Africa at the present day. None have been found in ancient Egypt at all resembling them, and the few specimens of early date from Mesopotamia also bear no resemblance to them.[1] It affords a proof of the isolation of the Indus Valley from the rest of the ancient world, save in trade, that a people there should have used such primitive weapons when countries not so far away, Elam and Sumer, as early as and before 3000 B.C. had the socketted type of weapon in use and a strengthening mid-rib.

Tangs. It will have been noticed that the tangs of most of the spear-heads are comparatively long; those of Nos. 1, 4, and 7 in Pl. CXXXVI are broken. As a rule, a long tang is not required for implements used for thrusting; but just enough to enable the blade to fit securely in its shaft and to prevent side-play. The end of the tang of the spear-head illustrated in Pl. CXXXVI, 6, was sharpened to an edge to facilitate easy insertion into the shaft. This, coupled with the fact that all the tangs are rectangular and not round in section, strongly suggests that hollow shafts were used, such as bamboo.

Plate CXXXVI.

Descriptions. No. 1 (C 1978). See also Pl. CXXXV, 2. Length, 9·1 inches; breadth, 4·1 inches; 0·15 inch thick near tang. Probably a portion of the tang is missing. Point and edges blunted by corrosion. A slight concavity in one edge of the blade is perhaps due to constant sharpening. Material, copper. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

No. 2 (HR 3832). Length, 7·6 inches (estimated length, 8·3 inches); breadth, 2·6 inches; thickness, 0·12 inch. Material, copper. Level, 4 ft. 2 in. below surface. Room 62, House IX, Block 2, HR Area.

No. 3 (HR 5799). See also Pl. CXXXV, 1. Total length, including tang, 7·15 inches; breadth, 2·62 inches; thickness of blade, 0·12 inch; thickness of tang, 0·2 inch. It is quite evident that this weapon was beaten out from a strip of copper not much thicker than the present thickness of the tang. Point, perfect and rounded. Edges, blunt and a little thinner than the middle of the blade. Material, copper. Level, 3 feet below surface. Second street in front of House XXIII, Block 5, HR Area.

No. 4 (C 1978). Tang, tip, and portion of side missing. Present length, 7·68 inches; breadth, 2·7 inches; thickness of blade and tang 0·12 inch, tapering down to 0·06 inch at the point. Material, copper. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

No. 5 (HR 5415). Lance-head measuring 3·15 inches long by 1·19 inches wide by 0·09 inch thick. Irregular in shape. Flat tang, 0·35 inch wide by 0·08 inch thick. Material, copper. Level, 5 feet below surface. Room 87, House IX, Block 2, Section B, HR Area.

Edged tang. No. 6 (HR 2742). See also Pl. CXXXV, 9. Point missing. Present length, 4·92 inches; breadth, 1·65 inches; thickness, 0·1 inch. Flat rectangular tang, 0·41 inch

[1] Cf., however, the so-called daggers of Anau. Petrie, *Tools and Weapons*, pls. xxxv, 99, and xxxvi, 130.—[Ed.]

wide by 0·1 inch thick. Tang runs to an edge for easy insertion in the shaft. Material, copper. Level, 5 ft. 2 in. below surface. Western side of First Street, HR Area.

No. 7 (HR 4458). Length, 4·8 inches; maximum breadth, 1·8 inches; thickness, 0·06 inch. Material, copper. Level, 3 feet below surface. Lane 1, between Houses III and VII, Block 2, Section B, HR Area.

No. 8 (SD 1062). See also Pl. CXXXV, 8. A very fine specimen. Length, 11·3 inches; maximum breadth, 3·5 inches; thickness near tang, 0·15 inch. Most of the blade is 0·11 inch thick. Very thin, and likely on this account to have been easily bent. Material, copper. This spear-head was unearthed at a level of 10 feet below the surface in the street between the eastern wall of the Great Bath enclosure and Block 1 of the complex of buildings south of the Stūpa area (Pl. XXVII).

No. 4 (HR 2872). Length, 3·82 inches; maximum breadth, 1·15 inches; thickness, 0·08 inch. Small tang. Material, copper. Level, 2 feet below surface. First Street, HR Area.

No. 10 (DK 1240). Length, 7·55 inches; breadth, 2·2 inches; thickness of blade, 0·09 inch. Tang, flat and 0·18 inch thick. Material, copper. Level, 6 ft. 9 in. below surface. Room 8, Block 2, Section C, DK Area.

Specimens of same type not illustrated.

SD 2007. Lance-head. Leaf-shaped. Length, 3·5 inches; breadth, 1·2 inches; thickness, 0·08 inch. Point missing. Material, copper. Found in Block 4 of Southern Buildings Section. Level, 4 feet below surface.

Arrow-heads

Absence of flint arrow-heads.

No arrow-heads of flint or any other stone have been found as yet at either Mohenjo-daro or Harappā, and there is therefore reason to think that only metal arrow-heads were used, at all events in the later periods. The specimen illustrated in Pl. CXLIII, 12, is the only type of arrow-head that has been unearthed, and it obviously had a flint prototype; for it is but a slight modification of the concave-based flint arrow-head known to us in Egypt,[1] Northern Persia, and Western Europe in the neolithic and chalcolithic periods. Metal arrow-heads of this shape are known in early Greece and the Caucasus.[2, 3]

Our specimen (DM 61), which unfortunately has lost the point of one barb, measures 1·33 inches long and 0·5 inch thick. It was evidently cut from a piece of sheet copper. Level, 5 feet below surface. Stūpa Section.

Knives and Daggers (Pls. CXXXV and CXXXVII)

Pl. CXXXVII.

No. 1 (HR 4212*a*). See also Pl. CXXXV, 5. This copper knife is 9 inches long by 2·2 inches wide by 0·12 inch thick. Both edges blunted owing to corrosion. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

True knife.

No. 2 (HR 5562). See also Pl. CXXXV, 3. Copper knife, 6·7 inches long by 1·23 inches wide. Back of knife thick near tang (0·17 inch) and fines down towards tip of blade. Edge sharp and graduated. Rough tang, rectangular in section with slightly rounded angles. Level, 7 ft. 6 in. below surface. Structure V, Block 2, Section B, HR Area.

[1] Brunton and Caton-Thompson, *The Badarian Civilization*, pl. lxxxiii.

[2] Petrie, *Tools and Weapons*, p. 35, pl. xli; Glotz, *Aegean Civilization*, p. 90.

[3] Three perfect specimens have since been found at Mohenjo-daro.

Leather-cutter. No. 3 (HR 4057). See also Pl. CXXXV, 6. This object may possibly be a leather-cutter, since its tip is curved. It has been restored in Pl. CXXXV, 6, from a perfect example found at Harappā. Present length, 6·2 inches; estimated width, 2·1 inches; thickness, 0·1 inch. Flat tang, averaging 0·42 inch wide and 0·12 inch thick. Appears to have been edged only on the convex side. Material, copper. Level, 3 ft. 5 in. below surface. Western side of First Street, HR Area.

No. 4 (HR 4212*a*). See also Pl. CXXXVIII, 9. A piece of bronze that seems to have been intended for a knife; 2·58 inches long by 0·15 inch thick; tapers gradually towards the right hand. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

Absence of rivet-holes. The first three specimens have fairly long tangs and the absence of rivet holes shows that they were just inserted into wooden handles without any other fastening.

No. 2 is a true knife, for it has an edge only on one side. The leather-cutter (No. 3) also seems to have but one edge, but corrosion could easily account for the blunting of the other. This implement was probably used for paring small hides.

The smallness of the number of knives and daggers found at Mohenjo-daro is rather arresting, unless we include as knives some of the narrower implements grouped amongst the spear and lance-heads.

Razors (Pls. CXXXVII and CXXXVIII)

Curved form. The blade illustrated in Pl. CXXXVIII, 11, appears to be a razor (VS 3054). It is 2·2 inches long and has a fine curved edge, 1·05 inches wide. There are two holes at the back, 0·08 inch in diameter, by which it was riveted to a handle. Possibly the handle was set at right angles to the blade, as was the case with many of the ancient Egyptian razors.[1] The blade has swollen slightly through corrosion, but it is estimated that originally it was 0·12 inch thick. Material, bronze (?). Level, 5 feet below surface. South-western corner of House XVII, VS Area.

What is seemingly a razor of another kind (L 238) is illustrated in Pl. CXXXVII, 5, and in Pl. CXXXVIII, 12.[2] It is badly broken and now measures 2·38 inches across. Sharp curved edge. The average thickness of the blade is 0·9 inch. The tang, which averages 0·32 inch wide and 0·12 inch thick, is rectangular in section with slightly rounded edges. Material, bronze. Level, 6 feet below surface. Room 104, Block 8, L Area.

Saws (Pl. CXXXVII, 6 and 7; Pl. CXXXVIII, 4 and 8)

Shell cutting. The fine bronze saw (C 100–1) illustrated in Pl. CXXXVII, 7, and in Pl. CXXXVIII, 8, is of much the same shape as the iron saws used at the present day to cut up shell (see Chapter XXVIII). Its length is 18·3 inches and maximum breadth 6·3 inches. In thickness it now varies from 0·05 inch to 0·1 inch; but corrosion makes it difficult to estimate the original thickness. Its poor condition also makes it uncertain whether the tang was longer than it now appears. There are two holes in the tang for riveting. The upper one is 0·15 inch in diameter and situated 2·1 inches from the end of the tang and 0·58 inch from the upper edge of the saw. The second hole is smaller and separated from the first by a distance of 1·4 inches, which shows that the handle was of considerable width. It is uncertain whether the top of this saw was ever backed, as are the modern examples. There are no rivet holes along this part of the blade, but a backing of metal may have been squeezed on, or even wood may have

[1] Petrie, *Tools and Weapons*, pl. lxi, figs. 78 and 79.

[2] That the conjectural restoration is correct, is proved by numerous perfect examples since found at Mohenjo-daro.

been used to stiffen the blade. The teeth are well preserved at the tip of the saw and are dentate and somewhat irregular. Level, 5 feet below surface. Room 9, Block 12, Section C, DK Area.

Fragment of saw. What may have been a portion of a bronze saw is pictured in Pl. CXXXVII, 6, and again in Pl. CXXXVIII, 4. The upper edge is straight like that of a saw; the lower edge is unfortunately broken. As, however, two parts of it are in the same straight line, we may suppose that they are parts of the original edge and that the saw was not very wide, i.e., some 2·48 inches. One rivet hole, 0·12 inch in diameter, is seen in the illustration and a trace of another can be made out in the curved portion of the saw to the right of it. A portion of the tang, which is 1·23 inches wide and 0·14 inch thick, is missing; it was broken off at a third rivet hole. No teeth are now visible. Level and number unknown.

Sickle-shaped Blade (Pl. CXXXVIII, 10)

Convex edge. From the curvature of this copper object (VS 1802), which is 4·7 inches long and 1·05 inches wide, we may perhaps conclude that it is a portion of a sickle-blade. The pointed end is the original shape, but probably a large portion is missing from the square end. Curiously enough, the inner edge of this fragment is of thicker metal (0·15 inch) than the convex side, towards which the metal fines down to a sharp edge. The outer edge must, therefore, have been the cutting edge. This object may perhaps be compared with the sickle-shaped pieces of metal that have been found at Kish and that still remain unexplained.[1] Level, 4 feet below surface. South-western corner of House XXI, VS Area.

Fish-Hooks (Pl. CXLIII, 24 and 25)

Fish-hooks are common at Mohenjo-daro, but the examples found are generally very badly corroded.[2]

No. 24 (DK 4140) is in very bad condition. It is 1·65 inches long and the maximum thickness of the shank is 0·15 inch. It appears to be bronze. Level, 7 feet below surface. Room 61, Block 7, DK (*g*) Area.

Loop-eye. No. 25 (HR 3312) is 1·95 inches long and the maximum diameter of the shank is 0·12 inch. The end of the shank has been fined down and bent over to form an eye. Bronze. Level, 3 feet below surface. House IX, Block 2, Section B, HR Area.

Chisels (Pls. CXXXV and CXXXVII)

Types. The chisels are of three types:—

1. Rectangular or square in section with dimensions very much the same along their entire length, as Nos. 11 and 14 in Pl. CXXXV.
2. Rectangular or square in section with flattened tangs, as Nos. 12, 13, 15, etc., in Pl. CXXXV.
3. Round in section, as No. 15 in Pl. CXLII.

Manufacture. The first two types are frequently found, but the third is very rare. Chisels of Type 1 were made from square or rectangular rods of metal, which were probably cast in this shape, as it would have entailed considerable labour to hammer them out. In the majority of cases the sides and faces are parallel, but sometimes there is a slight thinning toward butt or edge, of which the latter is almost invariably slightly splayed. This intentional thinning was

[1] Mackay, *A Sumerian Palace*, pt. i, pl. xxix, fig. 6; pl. lxi.

[2] Possibly due to their being generally made of bronze.

probably produced by hammering, for both butt and edge would have required the additional hardness that in a copper tool can only be produced by the hammer. It is not possible to connect chisels of this type with those of any other country in particular, for the shape is common to most early civilizations.

Indus Valley type. Type 2, however, seems to be confined to the Indus Valley civilization. The long, flattened shanks certainly appear to have been made expressly to be fixed in handles, for only one example has been found whose butt was badly burred by hammer blows (Pl. CXXXVII, 8). As it would have been difficult to bore a rectangular hole in a piece of hard wood to serve as a handle, we must conclude that a short piece of hollow bamboo was used; the comparatively sharp angles of the shank would prevent the chisel turning in a handle of this nature. This type of chisel would also be useful without a handle, as its flat end would prevent its twisting in the hand. That it was occasionally used without a handle is proved by the burred butt of the specimen mentioned above.

It might be thought that these chisels with flattened shanks were made with the idea of providing a broad edge to the tool as well as a narrow one. We find, however, that their butts are always cut off squarely. Only one chisel, and that not of this type, has been found with an edge at each end (SD 2052).

Pointed chisels. Chisels of Type 3 were probably used only for working stone. The specimen illustrated in Pl. CXLII, 15, has a plain point which is not edged in any way; it is best described as a pick-chisel.

Double-slope edges. As in the prehistoric chisels of Egypt, the edges of all those found at Mohenjo-daro have a double slope, which for the sake of strength is always abrupt. Not a single example of a single-sloped or true chisel has been found at Mohenjo-daro, though this form was used in Egypt as early as the First Dynasty.[1] At Susa the earliest chisels are also double-sloped, and so are all the Sumerian chisels of early date that I have seen.

Both Types 1 and 2 were manufactured from square or rectangular rods. There is, however, one exception, an unillustrated specimen (VS 2601), which was made from a round rod.

Mortise cutting. None of these chisels are suitable for deep mortise cutting, for their splayed edges would prevent easy withdrawal from the hole. Certainly none of them show evidence of having been used on hard materials. They were probably employed for simple woodwork, and it may be for soft stones, such as steatite, which was very commonly used at Mohenjo-daro.[2] The smaller tools were perhaps employed for graving; No. VS 2601 has such a narrow edge that there can be no doubt that it was used for work of this kind.

Bronze rare. Chisels of bronze are rarer than those of copper. Only three definitely bronze specimens have been identified (Pl. CXXXV, 15, and Pl. CXXXVII, 3*a*, 11). These are comparatively small tools, which suggests that tin was a rare commodity, though one would expect that, if so, it would have been more commonly used for such useful and hard-worked implements as chisels rather than for axes, whose weight alone would conduce to their longevity.

Type 1 (Pl. CXXXV, 11 and 14; Pl. CXXXVII, 3*a* and 11; Pl. CXLII, 13)

Descriptions. Pl. CXLII, 13 (SD 1899). See also Pl. CXXXV, 11. Length, 9 inches. Splayed edge, 0·64 inch wide, abruptly sloped on both sides. Made from a rectangular rod measuring 0·5 inch wide by 0·38 inch thick. Butt slightly burred by hammering. Tapers slightly towards butt and edge. Material, copper. Level, 11 feet below surface. Block 4, Southern Buildings Section.

[1] Petrie, *Tools and Weapons*, p. 19.

[2] Not, be it said, for large objects.

Pl. CXXXVII, 3*a* (VS 3599). 2·6 inches long, 0·45 inch wide, and 0·2 inch thick. Edge, 0·6 inch wide, splayed and abruptly sloped both sides. Butt very much burred. Material, bronze. Level, 2 feet below surface. Room 43, House I, VS Area.

Pl. CXXXVII, 11 (HR 3797). See also Pl. CXXXV, 14. Length, 3·85 inches. Breadth at unsplayed cutting edge, 0·25 inch. Made from a rectangular rod measuring 0·23 inch by 0·17 inch. Edge unequally sloped on the two sides. Butt shows no sign of hammering. Material, bronze. Level, 6 feet below surface. Chamber west of Room 46, House V, Block 2, HR Area.

SD 2052 (not illustrated). Length, 4·8 inches. Edge at each end. Made from rectangular rod, 0·24 inch by 0·12 inch. Material, copper. Level, 5 feet below surface.

Type 2 (Pl. CXXXV, 12, 13, and 15 ; Pl. CXXXVII, 8, 9, 10, and 12)

Pl. CXXXVII, 8 (HR 4212*a*). Length, 6 inches. Edge, 0·4 inch wide, abruptly sloped on both sides. Shank flat and burred over at butt ; measures 0·45 inch by 0·22 inch in section. Material, copper. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

Pl. CXXXVII, 9 (HR 4212*a*). See also Pl. CXXXV, 13. Length, 5·95 inches. Edge sloped gradually on both sides and slightly splayed, 0·43 inch wide. Shank flattened, measures 0·7 inch by 0·23 inch ; fines down slightly towards the butt. Material, copper. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

Pl. CXXXVII, 10 (HR 4212*a*). See also Pl. CXXXV, 12. Length, 8·2 inches. Made from a square rod, measuring 0·4 by 0·4 inch. Shank measures 0·7 inch by 0·16 inch and is cut square at the butt. Material, copper. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

Pl. CXXXVII, 12 (HR 4212*a*). Length, 5·05 inches. Edge missing. Made from a square rod 0·22 by 0·22 inch in section. Rod tapers towards missing edge which must have been quite narrow. Shank flat, measuring at the butt 0·4 inch by 0·15 inch. Material, copper. Level, 6 feet below surface. Room 8, House VIII, Block 2, HR Area.

Pl. CXXXV, 15 (D 603). Length, 3·6 inches. Made from rectangular rod measuring 0·12 by 0·8 inch. Flat shank, measuring 0·2 inch by 0·06 inch and fining down gradually to a blunt-edged butt. Material, bronze. Level, 4 feet below surface. Trench D, DK Area.

DK 896 (not illustrated). Similar in pattern to Pl. CXXXVII, 10. Length, 5·25 inches. Edge missing. Made from rectangular rod measuring 0·19 inch by 0·15 inch. Shank flattened, measures 0·35 inch by 0·11 inch. Material, copper. Level, 3 feet below surface. Space north of Block 1, Section C, DK Area.

VS 2601 (not illustrated). Similar in pattern to Pl. CXXXVII, 10, except that it is rounded in section towards its edge. Length, 4·55 inches. Shank flat and rectangular with square cut butt, measures 0·25 inch by 0·1 inch. Made from a round rod 0·12 inch in diameter. Its very narrow unsplayed edge, only 0·1 inch wide, was clearly intended for fine work. Material, copper. Level, 5 feet below surface. House XIII, VS Area.

VS 2701 (not illustrated). Similar to Pl. CXXXVII, 9. Length, 6·9 inches. Splayed edge, 0·32 inch wide, slopes on both sides. Made from rectangular rod measuring 0·28 inch by 0·24 inch. Flat shank measures 0·5 by 0·18 inch. Material, copper. Level, 7 feet below surface. House IX, VS Area.

HR 2089 (not illustrated). Length, 4·65 inches. Made from rectangular bar measuring 0·19 by 0·13 inch. Flat shank, measuring 0·35 inch wide by 0·12 inch thick, and fining down slightly towards butt. Material, copper. Level, 8 feet below surface. From ground between Houses III and VI, Section A, HR Area.

Type 3 (Pl. CXLII, 15)

Pl. CXLII, 15 (L 1186). See also Pl. CXXXV, 16. Length, 4·55 inches. Butt partly missing, round in section; now measures 0·39 inch in diameter. Fines down to a blunt point. Material, copper. Level, 2 feet below surface. Room 58, Block 2, L Area.

Awls and Reamers (Pls. CXXXV, CXLII, and CXLIII)

Plate CXLII.

Square point.

No. 14 (HR 4993). See also Pl. CXXXV, 7. An unusual object, 7·7 inches long, made from a metal rod 0·28 inch square in section. Towards the end it fines down to a point. The shank has been hammered flat and at the butt measures 0·37 inch by 0·1 inch. Point bent. From the sharpness of its angles it seems likely that this tool was used as a reamer. Material, copper. Level, 4 feet below surface. First Street, HR Area.

Plate CXLIII.

No. 31 (VS 540). 4·12 inches long. Round in section, 0·12 inch in diameter. Blunt point at one end and a more graduated point at the other, part of which is missing. Material, copper-antimony alloy. Level, 3 ft. 6 in. below surface. House XXI, VS Area.

No. 33 (HR 5805). 3·62 inches long and 0·13 inch in diameter. One end blunt, a gradual, but broken, point at other end. Material, copper-antimony alloy. Level, 2 feet below surface. House XLII, Block 5, Section B, HR Area.

No. 37 (SD 2511). See also Pl. CXXXII, 6. 3·52 inches long, with maximum thickness of 0·1 inch. Somewhat abrupt point at one end, long tapering point at the other. Material, copper. Level, 3 feet below the surface. Court 4, in the constructions south of the Great Bath.

These awls being of metal were probably used for heavier work than the bone awls illustrated in Pl. CXXXII and described in Chapter XXIV.

Needles (Pls. CXXXII and CXLIII)

Metal needles.

Pl. CXLIII, 20 (DM 187). See also Pl. CXXXII, 2. Copper (?). Is described in Chapter XXIV. Stūpa section, SD Area.

Pl. CXLIII, 21 (HR 300). See also Pl. CXXXII, 1. Copper (?). Is described in Chapter XXIV.

Pl. CXLIII, 36 (DK 430). See also Pl. CXXXII, 5. Copper (?). Is described in Chapter XXIV. Room 5, Block 9, Section C, DK Area.

Metal Rods (Pl. CXLIII)

No. 30 (DM 121). Round copper rod, 5 inches long by 0·18 inch in diameter. Both ends bluntly rounded. Level, 7 feet below surface. Stūpa Section, SD Area.

No. 32 (SD 1781). Round copper rod, 2·5 inches long by 0·1 inch in diameter. One end a blunt point, other missing. Level, 4 feet below the surface. Passage 12 of the Great Bath Building.

No. 34 (HR 5292). Round copper rod, 3·78 inches by 0·17 inch in diameter. Tapers very gradually towards the ends, which are both cut off square. Level, 6 feet below surface.

No. 35 (HR 4964). Round bronze rod, 3·35 inches long by 0·19 inch in diameter. One end cut off square, the other rounded and polished. Level, 6 feet below surface. Found with a second rod (2·62 inches long) in Room 105, House XII, HR Area.

The use of these copper and bronze rods is uncertain. It seems probable that they were used for applying cosmetics like the kohl-stick of both ancient and modern Egypt. Their blunt ends preclude their being awls, and the fact that the ends are usually carefully rounded and polished proves that they are not pieces of unused metal. **Kohl-sticks.**

Finger-Rings (Pl. CXLIII)

No. 1 (HR 4058). Internal diameter, 0·72 inch. Made of wire, 0·13 inch in diameter. Ends closely touching. Material, copper. Level, 2 feet below surface. Room 57, House V, Block 2, HR Area.

No. 2 (HR 2619). Internal diameter, 0·7 inch. Average diameter of wire, 0·13 inch. Ends taper slightly and touch. Material, copper. Level, 6 feet below surface. Court 49, House V, Section A, HR Area.

No. 3 (DK 3343). Internal diameter, 0·55 inch. Rounded ends just meet. Wire irregular, averages 0·15 inch in diameter. Material, bronze (?). Level, 2 ft. 8 in. below surface. Room 6, Block 8, DK (*g*) Area.

No. 4 (DK 3411). Made of four continuous coils of fine copper wire. Internal diameter, 0·6 inch. Wire slightly flattened, measures 0·08 inch wide by 0·07 inch thick. The ends of the wire do not meet, nor do they come opposite each other.[1] Level, 6 ft. 4 in. below surface. Room 77, Block 7, DK (*g*) Area. **Coiled wire.**

No. 5 (HR 6036). Internal diameter 0·65 inch. Slightly oval. Made of bronze wire of unequal calibre ; average diameter 0·06 inch. Level, 9 feet below surface. Room 85, House IX, Block 2, HR Area.

The remaining rings, Nos. 5–8, are simple strips of copper, with their ends just meeting in some, and in others overlapping slightly. **Flat wire.**

Earrings (Pl. CXLIII, 11)

An earring of very unusual shape is seen in Pl. CXLIII, 11 (HR 3254). The portion that was passed through the lobe of the ear is of bronze wire, 0·09 inch in diameter. This was formerly a loop, but has been bent out of shape, so that the earring now measures 1·5 inches long. The loop of wire was first passed through a ring of coiled wire and then through a glazed steatite bead of cylindrical shape, 0·24 inch in diameter and 0·13 inch high. Below this bead, seven beads of washer-shape with bevelled edges form a kind of fluted drop. The base of the earring is much corroded and a portion is missing. After being threaded through all the beads, the wire was probably secured by coiling its end so as to keep everything in position. Level, 4 feet below surface. First Street, HR Area. **Unusual type.**

Bracelets (Pls. CXLIII and CXLIV)

Pl. CXLIV.

No. 7 (HR 3987). Outside diameter, 2·55 inches. Round in section, measuring 0·3 inch in diameter. Points slightly tapered and do not meet. Material, copper. Level, 12 feet below surface. Room 11, House XIV, Block 3, Section B, HR Area.

No. 9 (HR 4999). A child's bracelet of copper. Outside width, 2 inches. Slightly oval in section, 0·29 by 0·22 inch in measurement. Tapered ends overlap slightly. Level, 6 feet below surface. Found in wall, Room 7, House II, Block 1, HR Area. **Oval section.**

No. 11 (L 652). Outside diameter, 2·41 inches. Made from a round rod of copper of unequal thickness and slightly flattened inside. Thickest portion 0·21 inch wide by 0·16 inch. Late Period. Room 16, L Area.

[1] The same type of ring, in silver and in copper, is found at all periods in both Mesopotamia and Persia.

Pl. CXLIII.

No. 26 (L 713). A child's copper bracelet. Outside diameter, 2·21 inches. Made from a rounded rod, 0·25 inch wide by 0·22 inch thick, with a slightly flattened inner surface. Ends taper only slightly. Level, 3 feet below surface. Room 15, Block 5, L Area.

No. 29 (HR 3988). Internal diameter, 1·42 inches. Round in section, except for a slight flattening on the inside; measures 0·28 inch by 0·25 inch. The ends, which are tapered, overlap a distance of 1·4 inches; they are not visible in the illustration. Material, copper. Level, 12 feet below surface. Room 11, House XIV, Block 3, Section B, HR Area.

Miscellaneous Objects (Pls. CXXXIX, CXLIII, and CXLIV)

Pl. CXXXIX.

Jar-handle. No. 11 (C 1978) is a bent-up piece of copper now measuring 7·5 inches long. It shows little attempt at working and appears to be a rough casting that for some reason was not used and was thrown aside to be melted up again. It was possibly intended for the handle of a jar, as a portion near the middle is flat and has two holes bored through it, each 0·08 inch in diameter. These holes seem to have been cast and both are bevelled. In section the longer end of this casting is lozenge-shaped, measuring 0·65 inch by 0·5 inch. The shorter end is rectangular in section, 0·62 inch wide by 0·3 inch thick. Level, 2 feet below surface. Room 14, Block 8, Section C, DK Area.

Pl. CXLIV.

Piping. No. 1 (C 100–1). A piece of piping, 22·5 inches long by 0·78 inch in diameter on the outside. Thickness of metal, 0·11 inch. One end is complete and the other missing. The complete end, which is slightly fractured, seems to have been open; the edge has been turned down outside the tube for a distance of 0·32 inch to stiffen it. There is no sign of a join or overlap to the tube, and it is possible that it was cast. Material, bronze (?). Level, 5 feet below surface. Room 9, Block 12, Section C, DK Area.

Copper bull. No. 2. Roughly modelled copper bull with lowered head and marked hump. A very curious feature is that one ear is tied to a horn by a strip of woven material; the folds and twists of this are clearly shown in the casting, though they are not seen in the illustration. The other ear was similarly treated, but corrosion has effaced all detail. The animal is a solid casting and there is a piece of waste metal near the tail which was not removed. It stands on a pedestal with a ring beneath. The object of this ring is difficult to understand; it could hardly have been used for suspension, as the bull would have hung upside down. Length, 1·85 inches.[1]

Shield boss (?). No. 3 (SD 2468). Irregular circular piece of copper, 3·3 inches in diameter at its widest part. Around its edge, which is sharply bevelled, are nine rivets and a hole that once contained a tenth. This object is probably a patch of some kind, or it may once have formed part of something else, e.g., it was possibly the boss of a shield.[2] The plate including the rivets averages 0·22 inch thick. Level, 4 feet below surface. Found between two walls on the northern side of Block 5, south of the Great Bath.

Copper animal. No. 4 (HR 4363). A copper model animal, whose species it is difficult to determine. The long snout, a portion of which seems to have been broken off, suggests an elephant.

[1] Another identical figure has since been found.

[2] It would perhaps be too small for this purpose, and there is no evidence of shields having been used by the Indus people.

This object was roughly cast—if the roughness be not due to corrosion. Its comparative lightness suggests that it is not solid right throughout. Length of animal, 1·25 inches. Level, 4 feet below surface. Room 40, House LV, Block 7, HR Area.

Nos. 5 and 6 show different aspects of a bronze figure of a dancing girl before cleaning; the same figure after cleaning is also shown in Pl. XCIV, 6–8. This little figure is fully described in the chapter on the figurines (Chapter XVIII). Level, 6 ft. 4 in. below surface. Room 40, House LV, Section B, HR. Area.

Bird. No. 8. Roughly made hollow copper casting of a bird, now 1·1 inches high. Is broken and has a portion missing. From the shortness of its beak it seems likely that a dove is represented. The eye-holes appear to have been drilled, doubtless to take inlay.

Copper tube. No. 10 (HR 4964). Possibly a tubular covering of a handle; upper portion missing, but lower edge perfect. Sides overlap slightly, but this may have been caused by earth pressure. Present length, 2·85 inches. Thickness of metal, 0·02 inch. A hole has been bored through at 0·35 inch from the lower edge, apparently in order to fasten this object by means of a nail to a wooden base. Level, 6 feet below surface. Room 105, House XII, Block 2, HR Area.

Pl. CXLIII.

Nos. 9 and 10 (DK 2278 and 2279). See Pl. CLVIII, 3 and 7. Objects cast in copper or bronze, with cells to take pieces of inlay. They are described in Chapter XXVIII. No. DK 2278 was found in Room 14, Block 2, Section B, DK Area, and No. DK 2279 in Room 4, Block 16, Section C, DK Area.

Terminals. No. 13 (VS 2327) is a necklace terminal of a shape well known at Mohenjo-daro. Length, 0·78 inch. The thinnest portion is a copper tube, 0·21 inch in diameter and 0·02 inch thick. The tube shows no sign of a lengthwise join. One end of the terminal appears to be a cast bead, 0·38 inch in diameter, a portion of whose interior has been drilled out to take the tube. The bead appears to be of bronze, and the tube of copper. Similar terminals are seen at the ends of the girdle illustrated in Pl. CLI, *b*. Level, 6 feet below surface. Room 105, House XVI, VS Area.

Nos. 14 and 18 (E 2044 and L 572) are bronze girdle terminals of a shape which is frequently found at Mohenjo-daro. The first is described in Chapter XXVI, and illustrated in position in Pl. CLI, *b*. Room 1, House I, Trench E, DK Area. The second comes from L Area; it is made from a single piece of metal without the use of solder. Its maximum width is 2·08 inches and it is 0·24 inches thick. The inside is hollow and there is a hole, 0·19 inch in diameter, at the apex of the curved portion. Level, 2 feet below surface. Room 23, Block 4, L Area.

Spacer. No. 15 (C 95) is a six-holed bronze spacer, 2·35 inches long by 0·25 inch wide by 0·05 inch thick. The holes are slightly oval and average 0·1 inch in length. It is uncertain whether they were purposely made oval, or whether they were worn so by the threads passed through them. Level, 4 feet below surface. Room 9, Block 12, Section C, DK Area.

Beads. No. 16 (C 95). Group of cast bronze beads, slightly cylindrical in shape and with rounded edges. They vary somewhat in size, averaging 0·27 inch long by 0·3 inch in diameter. They are all pierced, but it is uncertain whether the holes were made in casting or were drilled afterwards. Probably both methods were employed. Level, 4 feet below surface. Room 9, Block 12, Section C, DK Area.

Spacer.

No. 17 (HR 5660) is a five-holed bronze necklace spacer, 2·39 inches long by 0·42 inch wide by 0·09 inch thick. The holes have been filled up by corrosion. Level, 4 feet below surface. Room 112, House XLVI, Block 5, Section B, HR Area.

No. 19 (HR 6186) is a group of bronze buttons, which are described in detail in Chapter XXVI. Level, 6 feet below surface. Chamber 107, House XII, Block 2, HR Area.

Copper casting.

No. 22 (HR 5650). This object is a copper casting, 0·9 inch high and varying from 0·6 inch to 0·65 inch in diameter. At the tapered end it is hollowed out to a depth of 0·75 inch, the resulting walls being 0·1 inch thick. It was evidently intended to cap something, perhaps a handle. It has been left in the rough state in which it was taken from the mould. Level, 5 feet below surface. West Court (19), House XVIII, Block 4, HR Area.

No. 23 (DK 1695). A cross-shaped ornament somewhat irregularly cut from a flat piece of copper. Measures 1·05 inches across and is 0·03 inch thick. Level, 2 feet below surface. Street between Blocks 8 and 9, Section C, DK Area.

Chains.

No. 27 (HR 4410). This type of chain is still extensively used at the present day.[1] Each link was cut from a strip of copper or bronze, 0·05 inch wide by 0·05 inch thick. Owing to corrosion, no sign of soldering is visible ; it is probable that the links were cut out whole from a flat sheet of metal and then bent into shape. The fact that the metal of which they are made is rectangular in section suggests this latter process. Each link is 0·55 inch long with a maximum width of 0·22 inch. Level, 6 feet below surface. House LIX, Block 8, HR Area.

No. 28 (HR 3433). Each link of this piece of chain is made of round bronze or copper wire, 0·08 inch in diameter. The links were once presumably oval, but have been pulled out of shape. There are no signs of soldering, but as the ends of the wire forming each link neither overlap nor are twisted together, some metal must have been used to join them. Level, 5 feet below surface. Southern portion of Room 46, House V, Block 2, HR Area.

[1] It was used in Egypt at the time of the sixth dynasty. Petrie, *Arts and Crafts of Ancient Egypt*, p. 87, fig. 94. A gold chain of the same pattern was found in an E.M. II tomb at Mochlos. Evans, *Palace of Minos*, vol. i, p. 98, fig. 69.

CHAPTER XXVI

PERSONAL ORNAMENTS

As in most ancient countries, the women of the Indus Valley decked themselves out with jewellery, and it is probable that the men did likewise. The commonest ornaments were long strings of beads, some of considerable size. None of the male figurines, except one,[1] are ever represented as wearing ornaments, but that men did in fact do so is definitely indicated by holes cut in the necks of some of the stone statues, in which to tie the ends of a string or strings of beads.

One male statue at least wears an armlet (Pl. XCVIII, 1). But armlets are never represented on the clay female figurines and they were possibly worn only by certain classes. The bronze figure seen in Pl. XCIV, 6–8, represents a dancing girl—always an inferior class in India—and the left arm is almost concealed beneath a multiplicity of such ornaments. This little statue does not give us any indication of the material of these bracelets, but if they were made entirely of metal the weight must have been excessive.[2]

Some of the gold jewellery that has been found beneath the pavements of houses is of quite an elaborate nature. Gold and silver were evidently by no means rare metals at Mohenjo-daro. We find pure gold as well as a kind of electrum, which may be either natural or artificial. Bronze and copper were also used in the manufacture of spacers and terminals for strings of beads.

There is a link between Sumer and ancient Sind in the use in both countries of a fillet around the head, a thin ribbon of either gold or silver, whose ends were tied at the back of the head by means of a thread. At Mohenjo-daro fillets were worn by both sexes. Apart from the use of these fillets, there is little resemblance between the style of hairdressing in the two countries.

Stone beads of practically every shape and form were in use. Some are of large size and are even made of such comparatively soft stones as limestone and alabaster. Beads of this kind could hardly have been worn solely for purposes of ornamentation (unless they were painted); probably they served also as amulets. The favourite material for beads was chalcedony in all its forms, carnelian being especially common and artificially treated to enhance its colour. No precious stones, as we understand them, were used, perhaps on account of their extreme hardness and the difficulty of working them. That they were known seems probable, as India is a country especially rich in them.

Only four examples have been found at Mohenjo-daro of carnelian decorated with white lines, but that this technique was well known is shown by beads and other objects being made of other substances to simulate decorated carnelian (Pl. CLVII, 8–12).

[1] The figure illustrated in Pl. XCIV, 509, 11.

[2] See *infra*, p. 531, note 2.

There is every probability that in India bead-making was one of the most ancient arts, since in most places the requisite materials were ready to hand. This was not the case in Mesopotamia, where even the commonest stone was difficult to procure.

A city site is rarely sufficiently productive of the jewellery and ornaments worn by a people for a really comprehensive survey of them. Beyond those rare finds that occur beneath the pavements of houses and hoards that have been buried by thieves, but little jewellery is unearthed in the ruins of a city. For a proper study of this subject we have to rely in most cases on cemeteries ; and, unfortunately, we have had no success as yet at Mohenjo-daro in our search for the graves of the dead. Were a cemetery to be found, we should doubtless obtain from it a much more extended knowledge of the personal ornaments of the people than is at present possible.

Beads (Pls. CXLV, CXLVI, and CXLVII)

The beads that are illustrated in Pls. CXLV, CXLVI, and CXLVII are for convenience divided into types, as described below :—

Cylindrical Beads (Pl. CXLV, 1–10)

Beads of this shape are quite common at Mohenjo-daro. They vary greatly in length, from long thin specimens to beads so short that they might almost be described as disc-shaped.

Materials used. The materials used in the manufacture of these beads are very varied ; those illustrated are made of the following materials :—(1) Soft black stone ; Room 20, Block 4, L Area. (2) Faience. (3) Steatite ; Room 20, Block 4, L Area. (4) Steatite ; Room 15, Block 4, L Area. (5) Calcite. (6) Faience ; Trial Trench D, DK Area. (7) Pottery ; Room 71, Block 3, L Area. (8) Shell ; Room 45, Block 1, L Area. (9) Steatite with gold caps ; Room 2, Block 16, Section C, DK Area. (10) Calcite.

Capped bead. Bead No. 6, which is best described as tubular, is now a brown colour which suggests that it was originally green, the change being due to an oxide of iron. It is one of eighteen, of which seventeen were originally green and one blue, which has now faded to white. Judging from the size of the hole, this bead must have been threaded on a thick cord, as was apparently the case with the majority of the beads of this type. No. 9 was made of glazed steatite and capped at each end with gold.

Foreign comparisons. Cylinder beads of faience are found in considerable numbers at all ancient sites and they were evidently very popular at Mohenjo-daro. The string illustrated in Pl. CLII, 15, *f*, exactly resembles beads from ancient Egypt and Mesopotamia in both colour and shape.

Cog-Wheel Type (Pl. CXLV, 13–20)

Beads of this type are very common at Mohenjo-daro in both the Late and Intermediate levels, but are unknown at the ancient sites of Elam and Mesopotamia, nor do I know of their occurrence further west. **Materials.** These cog-wheel beads are always made of paste and are usually glazed. Their original colour was either green or blue, but in most cases the colour has entirely disappeared. One would have thought that faience was much too soft a material for beads of such a shape, and, as a fact, many of the projecting cogs are broken off. A number of them, however, on a string would mutually strengthen one another. All these beads were made in a mould, and in section are of various shapes, ranging from a simple disc (No. 13) to a short barrel-shape (No. 20).

Some of the beads of this type are marked with shallow concentric grooves on one side only, e.g., No. 15. Others are plano-convex, as No. 17. It seems hardly likely that these two varieties, with which must be coupled Nos. 16 and 18, were strung; possibly they were sewn to the clothing.[1] The great majority, however, were certainly worn as beads.

Shell. No. 15 is made of shell and was found in Room 72, Block 3, L Area. No. 16, of faience, comes from space 74 in the same block. No. 17, faience, was unearthed from Block 2, Section B, DK Area, and No. 20, also of the same material, from Room 15, Block 4, L Area. They belong to the Late Period, but seem to occur also at the latter end of the Intermediate Period.

Fluted Tapered Beads (Pl. CXLV, 21–3)

Pendants. Beads of this type were either used as pendants or were strung in couples with their wider ends together. From the levels at which they were found they appear to belong to both the Late and Intermediate Periods, but in neither were they very common. They were all made in moulds and are of a fine white paste coated with a glaze which appears to have been originally coloured blue.

Long Barrel-Cylinder Beads (Pl. CXLV, 24–32 ; Pl. CLI (*b*))

Plasma. This type of bead is of unusual interest, as similar beads found at Kish have been dated to the pre-Sargonic Period.[2] As, however, beads of this type were uncommon in early Mesopotamia and fairly plentiful at Mohenjo-daro, in both the Late and Intermediate Periods, there is reason to think that they were made in India and exported to Mesopotamia. They have apparently not been found in Elam. Beads of this shape were always made of a beautiful translucent red carnelian (Nos. 24–8), or of pottery (Nos. 29–32); the one exception, which, unfortunately, is broken, is of a dark green coloured chalcedony (SD 2508), known to geologists as "plasma".

Imitation carnelian. The pottery beads are probably an imitation of the carnelian beads. They are very roughly made and closely resemble pottery beads of the same shape found at Jemdet Nasr in Mesopotamia, which site is closely dated by its painted pottery to the period of Musyān in Elam. But only pottery beads of this shape were found at Jemdet Naar; there were none of carnelian. Sometimes these pottery beads are coated with a smooth red slip (Pl. CLII, 19, *a–c*).

Boring. Some difficulty seems to have been experienced in drilling the holes (slightly conical) through these stone beads, which is not to be wondered at considering their length. The boring was done from both ends, and in some cases the two holes did not meet exactly in the middle. All the beads of this type were probably cut and polished before the boring was commenced, for the translucency of the polished stone would naturally help the lapidary to see whether his drill-holes were running straight.

The boring of these exceptionally long beads was probably done with a piece of thin copper rod and emery powder. The abrasive used must have been exceedingly fine, since the holes throughout their length are polished[3]; the process, too, must have been laborious and doubtless there were failures, though it must be confessed that we have not yet found any. Once the drill was set in a perfectly straight line with the bead and had entered

[1] I imagine that they were attached to the clothing in the manner of sequins, as they have only one hole.

[2] Mackay, *A Sumerian Palace, etc.*, pt. ii, pl. xliii, figs. 8 and 9. These carnelian beads I regard as important from the point of view of dating our site. They seem not to have been worn in Babylonia later than *c.* 2700 B.C., and are also unknown in India, as far as I can ascertain, except in the Indus Valley civilization. At Kish the same form of bead was made in lapis-lazuli. *Ibid.*, pl. lx, Nos. 18 and 19.

[3] The same polish was found inside the early carnelian beads from Kish.

the bead a short distance, the process would become, in a measure, automatic; provided, of course, that not too much pressure was employed. Presumably some form of lathe was employed and the drilling done with the bead placed in a horizontal position.[1]

Finish. Though these beads, whether of pottery or carnelian, are not always quite regular in shape, they are sufficiently so to look well to the casual eye. The carnelian beads are exceptionally well polished and their ends are slightly rounded. The beads made of pottery have no slip, and their holes were probably made by moulding the bead upon a piece of fibre, which was burnt away when the bead was baked. Indeed, their irregularity suggests their having been moulded with the fingers.

An interesting bead of this type (L 993), found in Chamber 22, L Area, is shown in Pl. CLII, 18, and again in Pl. CXLV, 26. This is made of red carnelian, but is streaked and mottled with white markings—whether natural or artificial it is difficult to decide.

Short-barrel Beads (Pl. CXLV, 33–9)

Crystal. This shape of bead was extremely popular at Mohenjo-daro and was made in every conceivable material, including copper, bronze, gold, and silver. Crystal beads are rarely found, but when they occur it is usually in this form. No. 33 is uncommon in shape. It is made of shell and like most beads made in this material was threaded on a thick cord. The hole of No. 38 is unusual in the way it widens towards the outside at each end; this is not due to wear, as would be expected.

Jade. No. 34, a green jade bead,[2] was found with others in Room 2, Block 16, Section C, DK Area, and No. 35, of silver, was unearthed from Room 1, House I, Trench E, DK Area. No. 36, which is made of steatite, was found in Room 104, Block 8, L Area, and No. 37, also of the same material, came from Chamber 52, Block 1, of the same Area. No. 39, of white limestone, was unearthed in Chamber 10, Block 5, L Area. All five belong to the Late Period.

Long-barrel Beads (Pl. CXLV, 40–53)

This type of bead is also found in large numbers. Only those beads whose length is markedly greater than the diameter are included in this type. The smaller specimens are made of various materials, but the larger ones are either of faience or of varieties of soft stone, limestone being especially common. No. 46 is made of a comparatively soft black stone mottled with dark grey, and No. 50 is white limestone. This last comes from 7 feet below the surface in Block 3 of the Southern Buildings Section. No. 51 is a soft brown stone with green specks, and the large finely made bead No. 52, of limestone striped in white, red, and brown, comes from Passage 12 of the Great Bath building. No. 53 is made of agate and is the largest hard stone bead that has yet been found at Mohenjo-daro. No. 40 is from Room 30, Block 4, L Area; Nos. 43, 45, and 49 from Space 91, Block 9; No. 46 from Chamber 20, Block 4; No. 47 from Room 4, Block 5; and No. 53 from Chamber 37, Block 1, L Area. With the exception of the last, all these beads belong to the beginning of the Late Period.

Barrel-shaped Beads, Oval in Section (Pl. CXLVI, 1–15)

Early type. This type of bead also is found in considerable numbers in all the levels at Mohenjo-daro and is made in a large variety of materials, including silver and gold. Some of the beads of this type are very flat in section and others considerably fuller, Nos. 11 and 14 being very

[1] The bow-drill was probably used.

[2] See Pl. CXLVIII, *a*, Fig. 6, and p. 519 *infra*.

nearly round in section. No. 15, which is of shell, is flat on one side and half round on the other, a shape that is not uncommon in this type of bead. The same shape is well-known at Jemdet Nasr, where it is associated with early painted pottery. It is also found at Nāl in Southern Balūchistān, another early painted pottery site.[1]

Bead No. 2 was made of a white stone veined with black and was found in Room 83, Block 4, L Area. No. 3, of faience, comes from Room 112, Block 7, and No. 5, of white paste, from Room 21, Block 4. No. 8, made of faience, was found in Chamber 8, Block 5; and No. 10, of white paste, comes from Room 104, Block 8. No. 15, also of the same material as the last, was found in Court 69, Block 3, L Area. Beads 3, 8, 10, and 15 are of the Late Period and beads 2 and 5 of the Intermediate Period.

Rectangular Beads, Oval or Half-round in Section (Pl. CXLVI, 16–19)

These beads are numerous in both the Late and Intermediate levels, and were made of all kinds of materials. Those which are oval in section were by far the most popular, but beads that are half-round in section are far from being rare. No. 16, of glazed steatite, is of Intermediate date and was found in Chamber 14, Block 4, L Area. No. 17 is of agate, No. 18 of steatite, and No. 19 of green felspar.[2]

Disc-shaped Beads (Pl. CXLVI, 20)

Materials.

Disc-shaped beads were rare on the whole, though found in both the Late and Intermediate Periods. The specimen illustrated (No. 20) is of unusual size and made of faience. A very fine series of disc-shaped beads of gold separates the large green jade beads in the fine necklace in Pl. CXLVIII, *a*, fig. 6. Beads of this shape were also made in pottery (Pl. CLII, 20), but none in carnelian have as yet been unearthed at Mohenjo-daro, though they were exceedingly common in early Mesopotamia and in Egypt. The material most frequently used for this kind of bead was shell; in this material, however, the edge of the bead is flattened and the central ridge missing. No. 20 of Pl. CXLVI was found in the clay packing to the north of the Great Bath, at a level of 4 feet below the surface of the ground.

The absence from the site of the rougher make of carnelian disc-shaped bead, which is so common in early sites in other parts of the East, proves that bead-making was well advanced. It is, of course, possible that we may yet find this variety of bead in the lower levels, though, if they do occur there, we should have expected that examples would be picked up and re-used by the people who inhabited the upper levels. This rough form of disc-bead has been found by Sir Aurel Stein in Chalcolithic sites of Northern Balūchistān, and I gather that the same explorer has found similar beads in the south of that province.

Globular Beads (Pl. CXLVI, 21–7; Pl. CLII, 15 *a*, *b*, and *c*)

Metal forms common.

Globular beads in the majority of cases are small in size. They are made in all sorts of materials, except shell. There were minute gold beads of this shape in two hoards of jewellery found in the DK and HR Areas at Mohenjo-daro, all of them cast. Larger beads of this shape were also made in gold, silver, copper, and bronze, sometimes cast and sometimes beaten out of thin material and soldered together. The beads shown in group 15, *a*, *b*, and *c*, in Pl. CLII, are of blue faience, a type of bead that was very common in ancient Egypt, especially during the Twelfth Dynasty. This form of bead is found at all levels at Mohenjo-daro.

[1] *Mem. Arch. Surv. Ind.*, No. 35.
[2] From string No. 7, Pl. CXLIX. Cf. p. 523.

Analysis.

An analysis by Dr. Hamid of the glaze of one of these globular beads resulted as follows :—

	Per cent.	
Silica	87·11	
Ferric oxide and alumina	4·89	
Lime	2·42	
Magnesia	0·30	Bead No. HR 3352
Alkalies (by difference)	3·71	
Oxide of copper	0·52	
Loss on ignition	1·05	
Total	100·00	

Dr. Hamid states that he assumes that no foreign adhesive was used to bind the body of this bead together. The glaze alone was sufficient for this purpose. Only the surface glaze of this bead was examined ; the body is made of a softer material. The colour is now a faint blue.

No. 21, of steatite, comes from Chamber 15, Block 4, L Area, together with No. 27, which is made of limestone. No. 22, a carnelian bead, is from the same area and was found lying close to the surface in Chamber 104. Both Nos. 23 and 25, of gold, were unearthed in Room 1, House I, Trench E, DK Area. Nos. 24 and 26 are of glazed steatite. All seven beads belong to the Late Period.

Segmented Beads (Pl. CXLVI, 28–30)

Faience.

This type of bead is somewhat rare. The material is always faience ; Nos. 28 and 29 are blue in colour and No. 30, now yellow, was once green. The shape may have originated in the accidental sticking together of oval or globular beads in the process of being glazed, but on the other hand this type of bead, carved in ivory, has been found at Badari in Upper Egypt. No glaze has yet been found in the graves of the Badarian civilization, though glazing was practised by the early predynastic peoples of Egypt.[1]

Foreign examples.

The same type of bead, also in faience, is known in the pre-Sargonic period in Mesopotamia, and also in later times in Egypt, where it was especially popular, coated with various coloured glazes, during the Eighteenth and Nineteenth Dynasties. Stone beads of this shape have been found amongst Ægean material and dated to Early Minoan II.[2] Later on, the same type of bead, but in glaze, appears in Middle Minoan III.[3] Beads of this form appear to belong only to the Late Period at Mohenjo-daro.

Unclassified Types (Pl. CXLVI, 31–9)

The following beads, being of unusual forms, are described separately :—

No. 31 (L 689). Faience and unique in shape. The missing portion has been restored in the drawing. Level, 4 feet below surface. Found in Chamber 20, Block 4, L Area, and dated to the Late Period.

Lapis-lazuli.

No. 32 (DK). Faience. This shape is unusual at Mohenjo-daro, but fairly common in the pre-Sargonic graves at Kish, where it was made in lapis-lazuli.[4] DK Area.

[1] Brunton and Caton-Thompson, *The Badarian Civilization*, pl. xlix, fig. 76 (A. 3).

[2] For a description and history of these beads, see Evans, *Palace of Minos*, vol. i, pp. 491–3. Also Childe, *Dawn of European Civilization*, p. 39.

[3] *Univ. of Penns. Pubs. Anthrop.*, iii, 3, p. 184.

[4] *A Sumerian Palace, etc.*, pl. lx, 7 ; p. 183.

No. 33 (DK 2999). Glazed paste,[1] apple-green in colour. It is hollow and has four small holes in pairs near the base, set opposite to each other. It seems probable that this object is not in reality a bead, but was made to be sewn to a dress. The same shaped object has been found without the holes. A number of the perforated type, including No. 33, were found together in an upper level which can be dated to the Late Period. Level, 1 ft. 6 in. below surface. Room 3, House I, Block 1, Section B, DK Area.

Soldered bead. No. 34 (HR 4212*a*). This type of bead is made of two circular pieces of thin gold with a groove across the centre of each. The plates are soldered together with the grooves coinciding. (See also the lowest string of beads in Pl. CXLIX, *B*.) A very similar bead was found in the "A" cemetery at Kish, where, however, it was lozenge-shaped and made of silver; the method of manufacture was identical.[2] Room 8, House VIII, Section B, HR Area. Judging from the level at which they were found, 6 feet below the surface, No. 34 and the other beads found with it appear to belong to the Intermediate Period.

Lug of seal. No. 35 (L 402). Steatite. Semi-circular in section. This is possibly the lug of an ordinary stamp seal carefully rubbed down smooth to make it serve as a bead. The irregular placing of the hole somewhat confirms this. Found in Room 104, Block 8, L Area. Late Period.

No. 36 (VS 3474). Glazed paste. Disc-shaped with a deep groove round the edge. Late Period. Room 10, House V, VS Area.

No. 37 (HR 2467). Shell. Ornamented with lines and circles as well as having a serrated edge. Found at a high level; therefore, presumably belongs to the Late Period. House LXVI, HR Area.

Metal origin. No. 38 (HR 2211). Faience of a beautiful blue. Obviously an imitation of a metal bead in shape. It was found 7 feet below the surface and belongs to the Intermediate Period. House III, Block 2, Section A, HR Area.

No. 39 (L 468). Steatite. Only the rounded side is fluted, the flat side being left plain. Probably two of these beads were fastened back to back. Late Period. From Chamber 28, Block 4, L Area. Level, 4 ft. 6 in. below surface.

Decorated Beads (Pl. CXLVI, 41–53; Pl. CLVII, 8, 9, 10, and 12 (?))

Trefoil pattern. No. 40 in Pl. CXLVI simply shows the decoration of No. 41 (HR 3723), a steatite bead whose surface is somewhat irregularly covered with a trefoil pattern. Level, 5 feet below surface. Area south of Room 43, House V, Block 2, HR Area.

No. 42 (VS 3187). Steatite. A thick disc-shaped bead decorated on the edge with a wavy line. Level, 6 feet below surface. Lane between Houses XXXVIII and XXXII, VS Area.

Decorated carnelian. Nos. 43, 44, and 45 are three carnelian beads decorated with fine white lines which have been burnt into the surface of the bead. Only four beads of this kind have, as yet, been found at Mohenjo-daro, but the process is still carried on in India.[3]

No. 43 (VS 2546) was found in House XVII, VS Area, at a depth of 1 foot below the surface.

No. 44 (L 225) comes from Chamber 114, Block 6, Section A, L Area, from just beneath the surface.

No. 45 (SD 1198) was found in the passage west of Chamber 8 of the Great Bath building at a level of 5 ft. 5 in. below the surface.

[1] Possibly moulded steatite.

[2] Mackay, *A Sumerian Palace, etc.*, pt. i, pl. vii, fig. 11.

[3] I have seen an ornamented bead of this kind made by an old man in Sind.

The largest of these beads, No. 43, is also illustrated in Pl. CLVI, 9. From the level at which all of them were found they must belong to the Late Period.

Foreign examples. A number of very similar beads have been found at Kish in a cemetery of the pre-Sargonic period.[1] Several of these decorated carnelian beads were found at Ur in a necklace of a date between the eighth and fifth centuries B.C.,[2] and similar beads have been picked up in considerable quantities at Brahmānābād in southern Sind.[3] Mr. Cousens, however, is of the opinion that the specimens that he found belong to the historic period.[4] If this be so, the beads of the Ur necklace may be of late manufacture, but consideration must be given to the possibility that as carnelian beads are practically indestructible, the specimens from Ur are of much earlier date and had been re-used.[5]

Mr. Horace Beck is of the opinion that these beads were first etched before the white was applied to the ground. Where they are broken, the white lines can be seen to have penetrated for some distance, but the structure of the stone is continuous across the part where the colour has changed.[6]

Bobbin-shape. No. 46 in Pl. CXLVI (C 109) is a long, hand-made, bobbin-shaped bead of pottery, somewhat irregularly grooved. Though included amongst the decorated beads, there is a possibility that it was used for some other purpose. Level, 4 feet below surface. Room east of Chamber 6, Block 11, Section C, DK Area.

No. 47 (HR 3046). Pottery. Irregular in shape and ornamented with spiral grooves. Intermediate Period. Room 49, House V, Block 2, HR Area.

No. 48 (HR 4370). Faience. There is a decorated beading round the hole on each side of the bead.[7] Late Period. Level, 18 inches below surface. House XVI, Block 3, Section B, HR Area.

Trefoil design. No. 49 (L 668). Steatite. Cylindrical in shape with its entire surface covered with a trefoil pattern. Level, 5 feet below the surface. This bead comes from Room 8, L Area, and is dated to the Late Period.

Glazed pottery. No. 50 (HR 5026). Brown bead with white bands. An analysis of the glazes that cover this object will be found in Chapter XXVIII on "Ivory, Shell, Faience, etc." This bead has a pottery base overlaid with two coloured glazes. The latter were in a very ropy condition when applied and were subsequently re-heated in a kiln, though not enough to ensure a proper adherence of the inlaid brown bands to the glaze of the bead. On the outside this bead bears a remarkable resemblance to one wholly made of glass. It was only on taking a sample from it that we discovered its pottery interior. There can be no doubt, I think, that this bead is an attempt to copy the decorated type of carnelian bead. Level, 6 feet below surface. Room 18, House XV, Block 3, Section B, HR Area.

No. 51 (SD 123). Steatite artificially treated to represent decorated carnelian. The stone is brownish-red outside and grey inside. Level, 2 ft. 6 in. below surface. Late Period.

No. 52 (VS 130). Faience, still retaining some of its original blue colour. Cylindrical. Heavily grooved along the sides. Level, 2 feet below surface.

[1] Mackay, "*A*" *Cemetery at Kish*, pt. i, p. 56, pl. iv, fig. 30; *A Sumerian Palace, etc.*, pl. xliii, fig. 9; pl. lx, figs. 54–8; *JRAS.*, Oct. 1925, pl x.

[2] Mackenzie, *Ancient Civilizations*, p. 166.

[3] *Ann. Rep. Surv. Ind.*, 1903–4, pl. xlix. Cf. Cousens, *Antiquities of Sind* (Arch. Surv. Ind.), pp. 54 and 55, pl. xiii.

[4] Beads of this class have been found on many other historic sites in India.—[Ed.]

[5] Many of the Arabs of to-day in Mesopotamia and Egypt wear beads that they have picked up from ancient sites.

[6] From a personal communication.

[7] Compare shape with fig. 380, p. 113, t. vii of *Mém. Dél. en Perse.*

Inlaid bead. No. 53 (L 445). (See also Pl. CLII, 17.) Steatite. An exceptionally fine bead. The interiors of the trefoils were probably filled in with either paste or colour. The former is the more probable, for in the base of each foil there is a small pitting that may have been used for keying a coloured paste. The depth of the cutting is 0·05 inch. Level, 3 feet below surface. Late Period. Found in Chamber 27, Block 4, L Area.

The most interesting of these beads are those with the trefoil pattern, which also occurs on the robe worn by the statue pictured in Pl. XCVIII. The trefoils on both the beads and statue are irregular in shape and in this respect differ from the pattern as we ordinarily know it.[1]

Decorated carnelian copy. No. 8 (SD 1998) in Pl. CLVII is a long, rectangular bead measuring 1·5 inches long by 0·35 inch wide and thick. It is made of a coarse white paste that resembles powdered steatite. Its surface is covered with a smooth red slip that is ornamented, somewhat roughly, with three white bands, possibly in imitation of decorated carnelian. This unusual bead was found in Chamber 26 of the Bath Building, 8 feet below the surface.

Kushān beads. It is a little uncertain whether the objects seen in Pl. CLVII, 10 and 12, which were evidently coloured to represent decorated carnelian, were worn as beads or not. Their holes are very large, and if used as beads, they must have been threaded on a very thick cord. Objects very similar to these in shape, of Scytho-Parthian or Kushān date, which come from Chārsadda in N.W. India are quite definitely beads; a proof that this shape survived to a fairly late period.[2]

Pottery Beads (Pl. CXLVII, 37–40)

Chamfered apertures. A number of pottery objects found in the DK Area appear to be beads, for similar objects are seen strung together in Pl. CLII, 16. As the illustration shows, they are roughly made with strongly chamfered holes, which are unduly wide; indeed, the cord must have been very thick to prevent the beads wobbling upon it.

None of these beads are decorated in any way; some are quite plain and others are coated with a cream slip. They have been found at various levels of the Late and Intermediate Periods.

Spacers (Pl. CXLIII, 15 and 17; Pl. CXLVII, 1–20)

The number of spacers that have been found at Mohenjo-daro is quite remarkable, showing that many of the necklaces worn by the inhabitants must have been composed of several strings of beads.

Materials. The holes in the spacers range from two to six in number, and the materials of which they are made include faience, pottery, paste, copper, bronze, and gold. A great many of the spacers are single flat strips pierced with the number of holes required, but in some cases gold beads were soldered together to form spacers, as in the central string of Pl. CXLVIII, *a*, fig. 7. The majority of the spacers are flat rectangular beads (Nos. 2–9), which are nearly always plain, but occasionally decorated, as in No. 10, which is made of faience

[1] For another example of this ornamentation, see the bull illustrated in Jastrow, *Civilization of Babylonia and Assyria*, pl. liii, and the Sumerian bull from Warka shown in Evans, *Palace of Minos*, vol. ii, pt. i, p. 261, fig. 156. Sir Arthur Evans has justly compared the trefoil markings on this latter bull with the quatrefoil markings of Minoan "rytons", and also with the star-crosses on Hathor's cow. *Ibid.*, vol. i, p. 513. Again, the same trefoil motif is perhaps represented on a painted sherd from Tchechme-Ali in the environs of Teheran. *Mém. Dél. en Perse*, t. xx, p. 118, fig. 6.

[2] *Ann. Rep. Surv. Ind.*, 1902–3, pl. xxviii.

and is ornamented with concentric circles on one side only. Many of these spacers are very roughly made, e.g., the pottery example, No. 17. Even the metal spacers are not always free from irregularity, as may be seen from No. 18.

No type of spacer can be dated to either the Late or Intermediate Period exclusively. We shall probably find them in the early levels also, when these are excavated.

The following are the materials of which the various spacers that are illustrated are made :—

(1) Steatite ; Room 19, L Area. (2) White paste ; Room 30, L Area. (3) White paste ; Room 104, L Area. (4) Calcite ; Room 4, L Area. (5) Faience. (6) Glazed steatite ; Room 86, L Area. (7) Calcite. (8) White paste ; Room 15, L Area. (9) Faience ; Room 15, L Area. (10) Faience ; Room 56, L Area. (11) Pottery. (12) Faience. (13) Faience ; House LI, HR Area. (14) Shell ; Room 104, L Area. (15) Faience. (16) Faience ; House LI, HR Area. (17) Pottery. (18) Copper. (19) Copper ; Room 1, House I, Trench E, DK Area. (20) Gold ; Room 8, House VIII, Block 2, Section B, HR Area.

Terminals (Pl. CXLIII, 14 and 18 ; Pl. CXLVII, 21–7)

Multi-stringed necklaces.

For necklaces composed of a number of strings of beads terminals were necessary and were usually made of metal, either gold, copper, or bronze. The exceptions are mostly faience. No. 21 (E 2044), of bronze, is also shown in position in Pl. CLI, *B*, and will be dealt with fully in the description of this piece of jewellery.

No. 22 (HR 4604) is of faience. That it is a terminal seems likely from its shape ; the two strings of the necklace were probably passed through the terminal and knotted on the outside. Space between structures XLVIII and XLIX, HR Area. Level, 5 feet below surface.

No. 23 (HR 4212*a*), though like a terminal, is not one in the strict sense of the word. It is one of the gold caps of a bead in the seventh string in Pl. CXLIX, *b*, which came from Room 8, House VIII, Block 2, HR Area.

No. 24 (HR 4212*a*) is a gold terminal—one of those seen on the sixth string from the bottom in the same plate.

No. 25 (HR 2862), which is made of faience, from its shape can hardly be anything other than a terminal. Vicinity of First Street of HR Area. Level, 3 feet below surface.

No. 26 is a terminal made in gold. Found with other pieces of jewellery in Room 8, House VIII, Block 2, HR Area, at a depth of 6 feet.

No. 27 (VS 2101) is a triangular terminal of faience with holes to take four strings. A fifth hole through the apex of the triangle was provided to take a short cord to fasten the necklace at the back of the neck. This object is so far unique. From the position in which it was found it evidently belongs to the Late Period. House XXV, Block 4, VS Area.

Make.

The metal terminals are very simply made from thin sheet metal, in some cases entirely without soldering ; in others the metal was cut to shape and then bent over and soldered down one side. A hole was always pierced through the curved top of the terminal. The bases are always found open, but they appear to have once been closed by a thin sheet of metal pierced with holes, very similar in appearance to the usual type of spacer.[1]

[1] It seems to me that we have the same kind of terminal with beads attached portrayed on painted pottery sherds from Tépé Douecya in the environs of Susa. *Mém. Dél. en Perse*, t. xx, p. 113, fig. 19. Very similar terminals are also known in the eighteenth dynasty of Egypt.

JEWELLERY AND NECKLACES

Hoard No. 1 (Pl. LXII ; Pl. CXL, 1 ; Pl. CXLVIII, *a* and *b*)

Silver vessel. The jewellery illustrated in Pl. CXLVIII, *a*, was found in the silver vessel (DK 1341), illustrated on the right of the plate,[1] which was unearthed by Mr. Dikshit in a long trench that he dug to connect up Sections B and C in the DK Area. The site of this find is shown in Pl. LXII, Block 16, the find spot in Room 2, at the eastern end of the Block, being marked by a cross. As the walling in this Block is of the Late Period and the depth of the find was only 3 feet below the surface, this hoard of jewellery can be definitely dated to that Period.

Jade beads. The large necklace is made up of barrel-shaped beads of a translucent, light-green jade, measuring 0·9 inch long by 0·45 inch in diameter in the middle and 0·25 inch at the ends. These beads are not all accurately graded, but in this respect nevertheless they compare well with other specimens of ancient jewellery. Each jade bead is separated from its neighbours on either side by five disc-shaped gold beads, 0·4 inch in diameter and 0·2 inch wide, made by soldering two cap-like pieces together. The joint is very fine and can only just be detected in some of the beads.

In the front of the necklace seven pendants of agate-jasper are suspended by means of a thick gold wire passed through each, which was thinned out and coiled two or three times at its proximal end to form an eyelet for the cord. The pendants are separated one from another by a small cylindrical bead of steatite capped at each end with gold.[2] The smaller necklace (No. 7) inside the large one is made up of small globular gold beads, all of which are cast. The spacers were made by soldering two of these beads together, and it is probable that the beads were originally strung into a bracelet of two rows.

Chisel markings. Together with these strings of beads several rough pieces of silver were found, one of which bears chisel-marks remarkably like cuneiform characters. A cast of this piece of silver was submitted to Mr. Sidney Smith, of the British Museum, who, however, could not identify any definite sign upon it. This fragment, which measures 0·95 by 0·9 by 0·25 inch, is part of a bar, from which it was snapped after both ends had been struck with a broad chisel. Judging from this piece, the original bar was quite rough and had been run in a clay mould.[3]

Silver wire. A couple of silver earrings found in this hoard were made of wire, 0·2 inch in diameter, roughly bent round with the ends overlapping. The two bangles (Nos. 1 and 4 in Pl. CXLVIII, *b*) were each made of thin sheet gold wrapped over a core which has now disappeared[4]; the metal overlaps slightly on the inside of the bangles and no solder was used. The original diameter of these bracelets seems to have been about 3 inches, and a small hole bored at either end was probably intended for fastening the ends together. They had been bent up for remelting.

Conical gold cap. One of the most interesting objects found in the silver jar was the conical gold cap measuring 1·35 inches high, which is shown at the top of the plate (No. 2). It was made without soldering by being beaten out from a plate of gold, and was then stiffened by bending out the edge at right angles all round. Inside the cap a gold loop was soldered at the pointed tip, apparently in order to sew or fasten it to something. Metal ornaments of this shape are used in India at the present day, a strand of hair being passed through the loop inside to keep them in position on each side of the head.

[1] See also Pl. CXL, No. 1.

[2] We are not, of course, sure of the original order of threading.

[3] This silver fragment now weighs 23·389 grammes, but it should be noted that some of its original weight has been lost in the process of cleaning.

[4] No traces were found of a core of either shellac or bitumen in these or other bracelets.

Silver ring. Yet another object of interest is the silver ring shown at the bottom of the plate (No. 13), whose bezel, 1 inch square and 0·2 inch thick, bears a design of crosses and semi-crosses, similar to those in shell, illustrated in Pl. CLV, 34 and 35.[1] A border around the edge of the bezel is formed by two lines set close together with oblique dashes between them. The ring itself, which is a simple strip of silver 0·25 inch wide by 0·1 inch thick, is roughly soldered to the bezel. The back of the bezel shows traces of having been fused and the ring may have been discarded on this account. The band itself is broken and most of it is missing.

The two silver bracelets shown in Pl. CLXIV, *a* and *b*, were also found with this hoard. They are described later on amongst the bracelets.

Broken metal. From the fact that there was so much broken and scrap metal in this find, it appears that it belonged to a jeweller or a dealer in precious metals. Indeed, the gold bangles had been twisted up into as small a compass as possible, probably with a view to re-melting. The ring also was quite useless as an ornament.

Hoard No. 2 (Pl. LXV ; Pl. CXL, 4, 5, 9, and 18 ; Pl. CXLI, 5 and 12 ; Pl. CXLIII, 13 and 14 ; Pl. CLI, *B*)

Find in copper bowl. The very fine necklace (E 2044) illustrated in Pl. CLI was found in a large copper bowl which was covered by a shallow copper dish.[2] Both bowl and dish are illustrated in line in Pl. CXL, 9 and 18, and in photograph in Pl. CXLI, 12. An empty copper vessel lying beside them appears in Pl. CXL, 12. Together with the jewellery, the two covered dishes shown in Pl. CXL, 4 and 5, were found inside the bowl, and also the fragment of a copper censer illustrated in Pl. CXLI, 5.

Provenance of hoard. This hoard was found in the north-western corner of Room 1, House I, one of two buildings (M) excavated by Mr. Dikshit halfway along Trench E in the DK Area, the plan of which will be seen in Pl. LXV. The exact place of the find, which was at a depth of 4 feet below the surface, is marked by a cross on the plan. The date of the hoard can be safely placed to the Late Period.

Details. The long carnelian beads of the necklace or girdle (Pl. CLI, *B*) are 4·85 inches in length by 0·4 inch in diameter in the middle and 0·3 inch at the ends. The shorter beads are about the same in diameter, but 3·25 inches in length. These beads are beautifully made and of a bright translucent red colour. They were bored from both ends, the holes averaging 0·17 inch in diameter at the outer end and tapering slightly to a little less in the middle. These holes meet more or less accurately in the middle of the beads, but in a few cases the alignment of the two holes is so inaccurate that the thread can only be passed through the middle of the bead with difficulty. Any deviation from the straight in the alignment of the holes in beads of such length is most difficult to correct after the boring has begun ; it could only be rectified by employing a drill of larger diameter than that first used, and then only with a certain amount of difficulty. In some of the beads it is quite evident that a larger drill was employed at one end of the bead than at the other, probably for this very reason.

Terminals. At each end of the necklace or girdle there is a semi-circular terminal of hollow bronze like a flattened cup, measuring 2·2 inches each way, the metal of which is about one-fifteenth of an inch thick. There are no signs of a join or soldering in these terminal pieces, and it seems that they were beaten out of a piece of bronze without a join being necessary. These terminals can hardly have been cast ; the metal is too thin.[3]

[1] Large square bezels are very rare in ancient rings.

[2] The dish was adhering so fast to the bowl that a portion of the latter had to be cut away in order that its contents might be extracted.

[3] Pl. CXLIII, 14, and Pl. CXLVII, 21.

The globular beads at each end of the stone ones are of bronze; the spacers also appear to be of the same metal. The latter are 2·45 inches long by 0·27 inch wide by 0·1 inch thick. Each has six holes, all of which are slightly oval in section owing to wear.[1]

Make. A bronze tube (Pl. CXLIII, 13) was once fastened to the curved outer end of each terminal, with a knob-like head to prevent its passing through the latter. Both tube and head were made from strips of bronze bent round a mandril with the edges simply pressed together and not joined by solder.

Gold studs. Together with this necklace were found two gold studs, each 1·2 inches in diameter, apparently intended for the ears. They are shown in the same photograph (Pl. CLI, 7, 8, and 11), in the middle and at the left-hand corner. The edge of each stud is decorated with a beading that was soldered on. This beading is so regular in make that one suspects that it was hammered or cast in a mould rather than filed into shape. In the centre of each stud at the back there is a hollow tube, 0·5 inch long and 0·27 inch in diameter, which tapers very slightly towards the outer end, on to which it is probable that another tube of slightly larger diameter fitted with a smaller head for the back of the ear. That these two objects could not have been used as nose-studs is shown by the length of the tube fastened to each.

Netting needles (?). Three very curious objects found with the studs and the necklace appear to be netting needles of gold. They are shown just above the ear-studs and also in the lower right-hand corner of Pl. CLI, *B*, 3–5 and 12–14.

The largest of these needles (E 2044*a*) is 2·5 inches long. The handle is hollow and cylindrical and tapers slightly, being 0·2 inch in diameter at the needle end. The needle point is 0·5 inch long and has a roughly shaped oval eye at its base.

The medium sized needle (E 2044*b*) is 2·5 inches long and of the same pattern; but the cap that closed the end of the handle is now missing. The point which has an oval eye at its base is 0·3 inch long.

The third needle (E 2044*c*) is only 1·7 inches long, with the point 0·3 inch in length. Its handle, which is otherwise similar to those of the other two needles, is badly dented.

The exact use of these three objects is open to question, for they could have been used for either sewing or netting. The handles seem to have been drawn, as there is no sign of a soldered line, but the caps at either end were soldered on with an alloy that is very little lighter in colour than the gold itself. The two smaller needles have evidently been held between the teeth on more than one occasion.

Bead-caps. A number of bead-caps, shown in the centre of the plate, were also found in the copper bowl, but not the beads to which they once belonged. The gold of which the caps are made varies greatly in colour, ranging from almost coppery-red to pale yellow. These caps were first drawn out of sheet gold to form a tube, and one end was then covered with a gold plate soldered in position. The other end of the tube was adjusted to fit the end of the bead. The longest of these caps is 0·75 inch long by 0·48 inch wide; all are oval in section.

Unusual ornament. Another curious ornament (No. 9) found with this hoard is shown just below the smaller objects in the Pl. CLI. It is an irregularly shaped bead of turquoise matrix with a minute hole through the centre and capped at each end with gold. A long gold bar with its ends bent at right angles acts as a kind of clip to keep the gold caps against the stone.[2] A silver tube was soldered inside each cap to allow of a thread being passed through them more easily. It would appear that the two gold caps were not originally made for this particular stone, as they do not fit it properly. Though the caps are of the same size, the hole at the outer

[1] Pl. CXLVII, 19.

[2] This bar arrangement is obviously so makeshift that one suspects that it was fitted at home.

end of one of them is 0·1 inch in diameter, and of the other 0·3 inch in diameter. The holes on the bent-over ends of the clip are also of different sizes. It is, of course, possible that this object is really a pendant rather than a bead, and that a bigger hole was required at one end than the other. The caps and clip seem to be electrum rather than pure gold, for they are very pale in colour and appear to have a large admixture of silver. The alloy might of course be either natural or artificial.

Electrum.

Hoard No. 3 (Pl. XXXIX; Plan; Pl. CXL, 2 and 3; Pl. CXLVII, 20 and 24; Pl. CXLIX; Pl. CL; Plan; Pl. CLII, 13)

Remarkable find.

A remarkable find of jewellery was made in the HR Area at a depth of 6 feet below the surface in Room 8 of House VIII, Block 2, Section B. The chamber belongs to the Late Period and the jewellery, therefore, must be of that date. This find is numbered HR 4212*a*, and the several necklaces made up of loose beads are distinguished by different letters according to their find numbers. The majority of the beads were loose in the soil, but there were indications that they were once wrapped up in cloth. A small silver jar (Pl. CXL, 3) was found with the beads with a fragment of cloth still adhering to it.[1] The small silver jar, No. 2 in the same plate, also formed part of the find, together with a copper vessel filled with implements of copper. The latter vessel was, however, in too fragmentary a condition to be restored and drawn.

Waste metal.

Judging from the quantity of waste pieces of metal, some of which are illustrated in Pl. CLII, 13, and the rolled-up condition of some of the gold ornaments, it appears probable that this hoard was the property of a goldsmith, who kept it by him until he had enough material to warrant re-melting.

Gold bracelet.

The chief object in this find is the gold bracelet (HR 4212*a* (*e*)), shown at the top of Pl. CXLIX, No. 3, which has been reconstructed from a number of loose beads. The gold spacers found with these beads show that they were originally threaded in six rows. The ends of this piece of jewellery are finished off with hollow, flattened, semi-circular terminals of gold, through a small hole in the outer edge of which the threads of the bracelet passed. These small beads were cast, and the spacers cut out of sheet metal. The terminals must have been beaten out of thin sheet gold, as there is no trace of soldered edges, and then pressed flat. One of the terminals and a spacer of this bracelet are illustrated in Pl. CXLVII, 20 and 24.

Pendants.

The necklace, No. 4, immediately below this bracelet in Pl. CXLIX is composed of minute gold beads, globular and cylindrical in shape, interspaced with tiny globular beads of steatite. The latter are now white, but a few of them show slight traces of the original blue glaze. The small cylindrical pendants on the necklace are made of gold and glaze; the latter has retained its sky-blue colour. They are attached to the cord of the necklace by loops of thin gold ribbon wire; this was doubled and the two ends were passed first through a gold washer, then through a gold cap on the end of the bead, then through the bead itself and finally through another gold cap. The two ends of the wire strip were soldered to the base of the lower cap (HR 4212*a* (*f*)).

String No. 5 (HR 4212*a* (*k*)) is made up of beads of various coloured stones, such as riband-jasper, carnelian, etc., alternating with small gold beads. The latter and also the two large gold beads on either side of the central ornament were cast, and some of the beads are capped with gold. The gold terminals are of the same pattern as those in bracelet No. 3.

[1] Cf. p. 585 *infra*.

String No. 6 (HR 4212*a* (*l*)) is made up of gold and glazed steatite beads in five rows held by eight five-holed spacers. The gold beads are minute and either globular or cylindrical in form. The steatite beads, which are cylindrical only, average in size 0·1 inch long by 0·08 inch in diameter, which is about the same size as the cylindrical gold beads.

Minute gold beads.

The necklace, No. 7, at the bottom of the Plate (HR 4212*a* (*d*)) is composed of flat gold beads, beads of onyx, green felspar and turquoise matrix, and small globular gold beads. The flat gold beads, one of which is illustrated in Pl. CXLVI, 34, were made by soldering together two circular pieces of gold, each grooved across the centre, in such a way that the grooves coincided to make the hole for threading. There is no sign of soldering at the edges; the solder was concealed between the two plates. The central bead of this string, which is agate, is capped at each end with gold. The dome-shaped caps of the pendants have small gold loops inside—a curious arrangement which is also seen in the hollow hemispherical bronze buttons with a loop inside that were worn both by the Hallstatt and Koban folk in Hungary and found in deposits assigned to the Early Bronze Age.[1] Very similar ornaments have also been found at Anau in Turkestan,[2] as well as among the jewellery described earlier in this chapter.

Method of manufacture.

The stones in this necklace were carefully selected for their colour as well as for the regularity of their markings, the latter being in some cases so even that they might almost have been artificially produced.[3]

Carefully matched stones.

The central string (HR 4212*a* (*i*)) in Pl. CL is a necklace of very fine beads of jade, jasper, carnelian, chalcedony, agate, etc. The first bead on the string is gold.

The second string from the inside (HR 4212*a* (*j*)) comprises beads of jasper, carnelian, agate, lapis-lazuli, etc., and six of silver. Outside this is a fine string (HR 4212*a* (*g*)) of stones of diverse materials, colours, and shapes, including two cleverly cut onyx eye-beads.

Onyx.

The outermost string (HR 4212*a* (*h*)) is also made up of beads whose variety in shape, markings, and colour is extraordinary. A long flat bead, oval in section, was a favourite shape. This necklace also includes several skilfully cut "cat's eye" onyx beads.

A full description of most of the stone beads by Mr. A. L. Coulson, of the Geological Survey of India, will be found at the end of this Chapter.

The find-spots of these three groups of jewellery leave no doubt that they belong to the "Indus" civilization. But it is noteworthy that in some respects they resemble jewellery of Achæmenian workmanship. Small globular beads of gold, separated by spacers and stones capped with gold, are well known in the jewellery of the First Persian Dynasty.[4] On the other hand, I have found at Kish a carnelian bead, capped at both ends with gold, of undoubted pre-Sargonic date. It is within the bounds of possibility that this bead came from India.

Capped beads.

As far as we can ascertain at present, silver was used more freely than gold at Mohenjo-daro; it was not the rare metal that it was in ancient Egypt or Sumer. Pending further analysis of the silver objects made by the Indus Valley peoples, we are uncertain from what sources the metal was obtained and what ores were used.[5] Dr. Lucas has pointed out[6] that silver is found in nature in three conditions—metallic, non-metallic in ores, and thirdly, combined with gold. Metallic silver is not likely to have been the source of the silver used at Mohenjo-daro; it is still rare and was necessarily still rarer in ancient times. Silver is more

Silver plentiful.

[1] Childe, *The Aryans*, p. 124.

[2] Pumpelly, *Explorations in Turkestan* (1904), vol. i, p. 153, fig. 259.

[3] I am inclined to think that in some cases they were.

[4] *Mém. Dél. en Perse*, t. viii, p. 56, figs. 91 and 92. See also Woolley, *Antiquaries Journal*, vol. iii, pl. xxx.

[5] The possible sources of silver and lead are discussed by Sir Edwin Pascoe at pp. 675–8 *infra*. See also pp. 29–30 *supra*.

[6] *Jour. Egypt Arch.*, Nov. 1928, pp. 313–19.

commonly found in the form of sulphide or chloride, mixed with other metals, e.g., lead, zinc, or copper, but a certain amount of knowledge and skill is necessary to reduce it to its metallic state. Silver frequently occurs in small quantities in conjunction with lead as argentiferous galena. Lead is by no means rare at Mohenjo-daro, and it may be that silver was extracted from this ore, for Dr. Hamid found a small trace of lead in a sample of silver submitted to him, the analysis of which I give below :—

Sample DK 5774, Intermediate Period.	Per cent.
Silver	94·52
Lead	0·42
Copper	3·68 [1]
Insolubles (silver chloride, etc.)	0·85
	99·47

Lead.

A sample of lead (DK 6314) that Dr. Hamid also examined for me contains no trace of silver.[2]

Dr. Lucas in his valuable paper cited above concludes " that the earliest Egyptian silver and, by inference, also that of Mesopotamia, was a natural alloy of silver and gold containing sufficient silver to have a white colour, and was not obtained from an ore ".

Electrum.

We have not yet chemically examined any of the gold found at Mohenjo-daro to ascertain if there is any proportion of silver mixed with it, but I have already pointed out that some of the gold is of a very light hue and that it closely resembles electrum. This might, of course, be due to the admixture of some other metal with the gold to harden as well as to cheapen it. On the other hand, the extensive use of natural electrum [3] in ancient Egypt suggests that this alloy may also have been employed in ancient Sind, and that it likewise occurred in a natural state in India. The above analysis, however, shows a very high proportion of silver and no trace of gold ; which again suggests that, unlike the earliest Egyptian silver, that of Mohenjo-daro was extracted from an ore. If this was so, the people of Mohenjo-daro, with whom must be coupled those of Harappā, had evidently considerable knowledge of metallurgy.[4] Whether, however, this art originated in India or elsewhere, it is as yet impossible to say.

Indian lead.

In Chapter XXXII Sir Edwin Pascoe points out that in ancient times, as now, lead was extensively mined in various parts of India, chiefly on account of the silver associated with it. Taking into consideration, therefore, the presence of lead in the sample of silver analysed by Dr. Hamid, it seems more likely that it was from argentiferous galena that the silver found at Mohenjo-daro was extracted.[5]

[1] Dr. Hamid suggests that the " cupellation " process may have been used for the extraction of silver from its ores, and that the presence of copper is due to adulteration. Mr. Sana Ullah considers that the parent ore was contaminated with copper. He instances the cerussite found in Balūchistān, which is frequently associated with cuprite.

[2] Minute traces of silver have been found in lead samples from Mohenjo-daro submitted to the Sumer Committee of the British Association. See p. 487 *supra*.

[3] Electrum in Egypt contains from 60 to 80 per cent of gold and 20 to 30 per cent of silver, with sometimes a trace of copper. See also p. 543 *infra*.

[4] I conclude that they prepared the metal, as well as afterwards working it up.

[5] The process of extraction of silver from lead is fairly simple. But unless the galena is exceptionally rich in silver, large quantities would have to be treated to obtain sufficient of the metal.

Stones [1]

Lapis-lazuli rare. A remarkable point about the beads is the comparative scarcity of lapis-lazuli; indeed, this material was rarely used for beads or anything else at Mohenjo-daro. In Mesopotamia, on the other hand, this stone was very commonly used, especially in the pre-Sargonic period at Kish, for cylinder seals as well as for beads, the source of supply probably being Persia, where the stone is abundant. In view of the numerous connections with both Sumer and Elam shown by the objects found at Mohenjo-daro, one would naturally expect lapis-lazuli to be nearly as common at Mohenjo-daro as in Mesopotamia, especially as India can obtain it from a nearer source than Persia, viz., from the Badakshān District of Afghānistān, a few miles above Firgamu in the valley of the Kotcha.

Common at Nāl. On the other hand, Mr. Hargreaves found at Nāl, in southern Balūchistān,[2] several strings of beads composed entirely of lapis-lazuli, both disc-shaped and cylindrical. It is possible that the lapis-lazuli found at Nāl came from Persia, and that, for some unknown reason, this source of supply was not readily available to the inhabitants of Mohenjo-daro. That this mineral could be obtained in Afghānistān may at that date have been unknown.

Green felspar. Green felspar (Amazon stone) was, on the other hand, much favoured as a material for beads. It is not yet known for certain whence it was obtained.[3] Beads of this stone were especially popular in the twelfth dynasty in Egypt and are known as far back as the pre-dynastic period of that country.[4] It is said to be found at Gebel Migif in the eastern desert of Egypt [5] and also in the Sudan.

Foreign examples. The occurrence of beads made of green felspar in many Chalcolithic sites in the Near and Middle East, India included, is interesting, as few localities are known from which the stone could be procured. Possibly in ancient times a considerable trade was done in this semi-precious stone, which may have been valued for other properties than its beauty. Some considerable difficulty was always experienced in working felspar into beads, for in whatever country they are found they are always very irregular in shape.[6] The stone seems particularly associated with painted pottery, though no specimens have been recorded as coming from Anau. It was not found in the "A" cemetery at Kish, though a few miles away it was fairly common at Jemdet Nasr, a definitely "painted pottery" site. It was also found at Nāl.

Turquoise. Turquoise and turquoise-matrix were also occasionally employed for beads at Mohenjo-daro, but not in Sumer. It was well known, too, in the earliest times in Egypt, which country obtained its supplies from Sinai. Very fine turquoise is still obtained from mines near Nishāpur in the Persian Province of Khorāssān.

Agate. The inhabitants of Mohenjo-daro also made extensive use of various varieties of agate, such as carnelian, chalcedony, onyx, etc., for making beads. Some of these stones seem to have been tinted artificially, chiefly the beautiful red carnelian with designs upon it in white (Pl. CXLVI, 43–5). The tinting of agate is still an industry of India,[7] and it is possible that

[1] The provenance of the stones found at Mohenjo-daro is discussed by Sir Edwin Pascoe in Ch. XXXII, pp. 677–84.—[Ed.]

[2] *Mem. Arch. Surv. Ind.*, No. 35, pp. 33–4.

[3] See *infra*, p. 678.

[4] Lucas, *Ancient Egyptian Materials*.

[5] Ball, *Geog. and Geol. of South-eastern Egypt*, Cairo, 1912.

[6] Its lamellar crystalline structure makes it brittle and difficult to work.

[7] Principally in the Rājpipla State of the Bombay Presidency.

in ancient times tinted stones and decorated carnelian beads were exported from India to Mesopotamia.[1]

Amethyst. Amethyst has been found at Mohenjo-daro, both in the form of beads and also in rough nodules. As it is a fairly common form of quartz its use has no special significance. It was a favourite material for beads in Egypt from very early times, but in Babylonia it seems to have been rare before the neo-Babylonian period, when it was extensively used for both smooth and facetted beads.

Steatite. It is of interest to note the very extensive use of steatite at Mohenjo-daro, both in bead-making and for other objects, and to note that it was coated with a blue glaze. Steatite beads are more common than those of any other material, and there is no doubt that the people of Mohenjo-daro as well as Harappā had access to plentiful supplies. This soft stone was very extensively used in ancient Egypt from the earliest times, and there also it was usually glazed. In ancient Babylonia, also, it was coated with a blue glaze, but not so frequently in that country. Lapis-lazuli, which was very popular, probably took its place.

Common stones. Even stones of such dull aspect as limestone and alabaster were made into beads at Mohenjo-daro, and we have numerous instances of even pottery being utilized for the same purpose. Doubtless, beads made of these materials were worn only by the very poor.

Unfinished Beads

Unfinished beads Several unfinished beads found at Mohenjo-daro—all of agate—show that they were shaped and smoothed before being bored (DK 1421, DK 2936, SD 254). The steatite bead (HR 2399), however, had been bored, though its form was left unfinished. But it must be remembered that, owing to the tendency of steatite to split along the cleavage planes, it was perhaps necessary to do the boring first in order to avoid waste of time, if breakage should occur.

In connection with agate beads which were shaped before being bored, it is interesting to recall that in the early periods of Egypt, beads were shaped by first boring and stringing them and then rolling them to and fro in a groove cut in an abrasive material such as emery.

Flaking. In making beads of the harder stones they were first of all chipped roughly into shape ; an unfinished onyx bead (SD 2325) is a long, barrel-shaped stone that had been roughly shaped first by very careful flaking, the marks of which were nearly, but not quite, removed in an attempt to trim it up.

Stone Pendants (?) (Pl. CXLVII, 28–36)

A number of very curious objects which are fairly common are illustrated in Pl. CXLVII, 28–36. They seem to have been associated with jewellery in some way, for they occur in several of the hoards.

Hornblende. Those of the type illustrated in Nos. 28, 29, and 31–3 were always made of a polished hard black stone. They are slightly conical in shape, with a flat base and a top sometimes flat, and sometimes slightly rounded. A characteristic feature of these objects is a deep groove running round the head just below the top.

Nos. 30 and 34–6 are different in form, though made of the same hard black stone.[2]

[1] Decorated carnelian beads have been found at Kish, and dated there to the pre-Sargonic period. *JRAS.* 1925, pp. 697 sqq.

[2] Composed chiefly of hornblende and is best termed an amphibolite. Sir Edwin Pascoe suggests that the present dark colour of these pendants may be due to some process of artificial darkening, such as heating in oil.

In these the base is wide and flat and the upper surface more or less rounded, and in some cases almost conical. In this type, the groove occurs close above the base ; possibly the objects of this group should have been placed the other way up.

Pendants (?). I am inclined to think that in both groups the groove was intended to take a wire, and that Nos. 28, 29, and 31–3 were perhaps used as pendants and Nos. 30 and 34–6 as ornaments of another kind. Objects of both groups have been found in both the Late and Intermediate Periods. No. 29 was found in Room 45, Block 2, L Area, and is dated to the Late Period, and No. 31 in Room 9, Block 16, Section C, DK Area. No. 32 was found in Room 13, Block 10, Section C, DK Area.

Fillets (Pl. CLI, *A*, 4–8)

Nose ornament (?). A set of three very curious gold fillets was found with the jewellery from the HR site that has already been described. No. 6, the largest (HR 4212*a* (*q*)) is a band of very thin gold averaging 0·4 inch in width, with a small hole at each rounded end and another at the bottom of the V-shaped piece in the middle. If these fillets were worn as they are photographed, it is possible that a cord was threaded through the hole in the middle of the fillet to support a heavy nose or forehead ornament. In modern Sind, especially heavy nose ornaments are often supported by a thread tied to the hair. These three fillets are somewhat out of shape, for each had been rolled into a ball, presumably for re-melting. Yet despite their age and ill treatment, the gold still retains a certain amount of spring. The pottery head in Pl. XCIV, 1, shows, I imagine, how these fillets were worn.

At the top of Pl. CLI (*A*, 1) a broken gold band (HR 4212*a* (*x*)) is shown, which had also been rolled up. This band measures 6·2 inches long by 0·75 inch wide and has two holes at each end and also a row of small holes along the upper edge. The row of small holes perhaps served to secure the fillet to a head-dress, or, if worn the other way round, beads or sequins may have been fastened along it.

Mode of stiffening. This ornament was stiffened by a very ingenious device, the metal being twice box-pleated lengthways, not far from either edge.[1]

On either side of the gold bangles, Nos. 2 and 3, are coiled up fillets (HR 4212*a* (*t* and *u*)) of another form, respectively measuring 16 inches long by 0·52 inch wide and 15·1 inches long by 0·35 inch wide. Both these fillets taper slightly towards the rounded ends, each of which is perforated with a hole.

Embossed design. A very interesting fillet of the same kind from the VS Area (VS 3091) was found in a niche in the south-eastern corner of House XIV, Block 2, VS Area, at a depth of 3 ft. 6 in. below the surface. It measures 16·5 inches long by 0·55 inch wide in the middle, and tapers to 0·4 inch wide at the carefully rounded ends. These ends bear a very rough design made by embossing the metal with a blunt point,[2] and in each there is a small hole which has been pulled slightly out of shape by tension. The metal is 0·05 inch thick, and is bright-yellow gold which still retains a good deal of its original spring. **Cult object.** The design on the two ends of this fillet is illustrated in Pl. CXVIII, 14, and resembles the cult object that is always represented in front of the unicorn animals present on most of the seals.[3]

[1] It is possible, however, that by this means three narrow strips of gold were joined together to form a wider band.

[2] The same method of ornamentation is to be seen on some of the jewellery from Mochlos, dated to the Early Minoan II Period. Evans, *Palace of Minos*, vol. i, p. 96, fig. 67.

[3] Pointed out to me by Mr. Hargreaves.

Comparisons. This last fillet is very similar in shape to a silver fillet found in a grave at Kish and dated to the pre-Sargonic period, which was also ornamented as well as stiffened by embossing with a point.[1]

Finger-rings (Pl. CXLIII, 1–8 ; Pl. CXLVIII, 13)

Finger-rings have occasionally been found at Mohenjo-daro, the best example being the silver ring in the hoard of jewellery discovered in the DK Area (DK 1341), which has already been described.

Materials. Small rings of shell, copper, and bronze, all of very simple design, found at varying depths at Mohenjo-daro, were probably worn as finger-rings, there being no reason to think that the inhabitants of Mohenjo-daro differed in this respect from their neighbours of Elam and Sumer. A number of these objects were found with the hoard in the HR Area and are illustrated in Pl. CLII, 13. Other finger-rings are described in Chapter XXV.

Earrings (Pl. CXLIII, 11 ; Pl. CXLVIII, 11 and 15)

Rarity. Earrings are, on the whole, rare at Mohenjo-daro, a fact which can possibly be explained by their not being removed from the body on its burial or cremation, whichever rite was practised. Even at the present day in India, earrings are not removed by the Hindus when preparing a body for cremation ; they become the property of the priest when the ashes are collected. Nor do the Muhammadans remove ornaments of this kind when burying their dead. Moreover, the very secure method of attaching earrings to the ear in the East precludes their being easily lost or mislaid, which would explain their being so rarely found loose.

Those earrings that have been found are not particularly interesting. As a rule they consist of a simple coil of wire with the ends slightly overlapping. Sometimes the wire is coiled round two or three times, making a circular band of about 0·15 inch wide and 0·75 inch in diameter. To avoid enlarging the hole in the ear the ends of the wire are not always brought together, but a narrower space is left for the lobe. The wire of which they are always made is a thin strip of metal that is hammered round. It would seem that the people of Mohenjo-daro did not use a draw-plate in making their wire, though this craft was known to the Sumerians, as proved by the wire of a gold chain found at Kish.[2]

Ear and Nose Studs (Pl. CLI, *b*, 7, 8, and 11 ; Pl. CLII, 7, 8, and 14)

The two gold studs in Pl. CLI, 7, 8, and 11, have already been described and reasons given for thinking that they were intended for the ears rather than the nose.

Nose studs. The three studs in Pl. CLII, 7, 8, and 14, are, however, somewhat different in shape, and it seems probable that they are nose studs. No. 7 (SD 898) is of faience, and is 0·6 inch in diameter and 0·35 inch thick with a head at the back 0·25 inch in diameter. There is no design on this stud.

No. 8 (VS 1537*a*) on the same plate is also of faience. It is 0·8 inch in diameter and has a projection at the back similar to that of No. 7. The edge of this ornament is serrated and there is a four-pointed star in the middle enclosed in a circle. House XXIII, VS Area.

[1] Mackay, *Report on the Excavation of the "A" Cemetery at Kish*, p. 52, pl. iv, No. 24. For an example from Ur, but decorated by a different process, see *Antiquaries Journ.*, vol. viii, pl. ix, 3.

[2] *A Sumerian Palace, etc.*, p. 182 ; pl. xliii, fig. 3.

The design of No. 14 (VS 63) is like that of No. 8, but the stud is considerably larger, measuring as it does 1·0 inch in diameter. The border of this stud more nearly resembles a cable pattern than does that of No. 8. Found in Room 6, House XXIX, Block 5, of VS Area. **Rope pattern.**

These studs were found at levels ranging from 1 ft. 6 in. below the surface in the case of No. 14 to 5 feet below (No. 7), and must therefore all belong to the Late Period.[1]

Bracelets (Pl. CXXXIV, 1–2 and 5–7; Pl. CXLIII, 26 and 29; Pl. CXLIV, 7, 9, and 11; Pl. CLII, 1–6 and 9–12; Pl. CLXIV, *a* and *b*)

The bracelets found at Mohenjo-daro were made of a variety of materials—gold, silver, copper, bronze, shell, vitrified paste, faience, earthenware, and pottery. No stone bracelets have yet been found.

The gold bracelets shown in Pls. CXLVIII, 1 and 4, and CLI, 2, 3, 9, and 10 are all of sheet gold, which was originally wrapped round a fibre core that has now entirely disappeared. The join of the gold wrapping was always on the inside of the bracelet; sometimes the edges overlapped and sometimes they were just allowed to meet. The ends of the bracelets were trimmed sharply off, apparently with a saw. **Fibre core.**

Two silver bangles found with the jewellery shown in Pl. CXLVIII (DK 1341) and pictured on Pl. CLXIV, *a* and *b*, are slightly oval in shape and were made on a core in exactly the same way as the gold bracelets. Their ends also have the sharp edges caused by the cutting of a saw. There is a gap of 0·15 inch between the edges of the metal on the inside of each bracelet,[2] and the average diameter of each in its thickest part is 0·55 inch. The diameter at the ends of each bracelet is 0·4 inch. The thickness of the sheet silver employed in their manufacture is one-thirtieth of an inch.

Copper and bronze bracelets are found in considerable numbers. They are always quite simply made of thick wire with the ends generally just meeting, or nearly so (Pl. CLII, 4, 5, and 6); the ends seldom overlap as in the earrings. The thick wire of which they are made was always hammered into the round. Nos. 4, 5, and 6 in Pl. CLII were found with thirteen others of similar make, in Room 1, House XIV, Block 3, of the HR Area, at a depth of 6 feet below the surface. **Wire bracelets.**

The bracelets made of faience were far more elaborate, as will be seen in Pls. CXXXIV, 1, 2, 5–7, and CLVII, 22 and 48. All the specimens illustrated are badly broken and it was felt, therefore, that drawings were preferable to photographs. **Faience.**

Plate CXXXIV.

No. 1 (VS 3603) is of a light green vitreous paste incised with a herring-bone pattern. Found in Chamber 50, House VI, VS Area, at a level of 5 feet below the surface. **Details.**

No. 2 (HR 4467), made of a vitreous paste, now of a greenish colour, has a deep groove around its edge. Level, 2 feet below surface. House XIX, Block 4, Section B, HR Area.

No. 5 (HR 5196) resembles No. 2, except that it has two grooves instead of one. It is made of faience and still retains a considerable amount of its original blue. Level, 6 ft. 6 in. below surface. Street between Houses LII–LIII and LVI, Blocks 7 and 8, Section B, HR Area.

No. 6 (HR 5196) is still more elaborate; it is ornamented with three grooves or flutings instead of two. Like No. 5, with which it was found, it is made of blue faience.

[1] They are also met with in the Intermediate Period.

[2] Probably caused by the swelling of the core before it decayed.

Plate CLII.

No. 3 (SD 427), also shown in Pl. CLVII, 48, is of a light green, vitreous paste with an incised herring-bone pattern on its outer face. This bangle was originally 3 inches in diameter by 0·3 inch thick and 0·45 inch wide. Found in Block 2 of the Southern Buildings Section at a depth of 4 feet below the surface.

No. 9 (L 1184) is a fragment of a bracelet with a deeply serrated edge.[1] It is made of faience and is now an apple-green colour. From Room 58, Block 2, L Area, just below the surface. Late Period.

Plate CLVII.

No. 22 (DM 132). A fragment of a bangle in glaze with a fluted decoration. Colour, a greenish-blue, which extends right through the material. Paste shows blow-holes and is of a vitreous nature. Level, 4 feet below surface. Stūpa Section, SD Area.

No. 48 (SD 427) is also illustrated in Pl. CLII, 3, and is described above.

Liable to breakage.

Bracelets of this material were particularly liable to breakage, though no more so than the glass bracelets that are so commonly worn in the East at the present day. The material of which bracelets Nos. 22 and 48 were made differs radically from that of the others. Instead of the paste being softer inside than on the surface, it is just as hard. It would appear that in these cases a glaze was mixed with the paste instead of only being applied to the surface, with the result that a much stronger material was produced.

Pottery bracelets.

Pottery bracelets, which were presumably worn by the poorer classes, are very common. The majority are roughly made, and in some cases the join is barely concealed, e.g., Pl. CLII, 11. An exceptionally well-finished specimen made of a very fine clay coated with a smooth pink slip is illustrated in Pl. CXXXIV, 7, and again in Pl. CLII, 12.[2] This bracelet was found in Room 116, Block 6, L Area. Late Period.

Heavy firing.

Another type of pottery bracelet was made of a heavily fired clay, dark brown or black on the outside and light grey inside, of a fine uniform texture, and free from blow-holes. Indeed, these bracelets are so heavily burnt that they ring like metal when struck and in some cases break with a glass-like fracture. Owing to their brittleness, they are practically always found in pieces, but a perfect specimen (HR 1325) is shown in Pl. CLII, 1, which was found in Court 18, House I, Block 1, HR Area, at a depth of 9 feet. In most cases, like the faience bracelets, these ornaments were made in a mould; the majority are very well finished.

Analysis.

Mr. Sana Ullah has made the following analysis of the material of which these particular bracelets are made. He would prefer to style this make of bracelet as stoneware rather than terra-cotta, for the former implies a better grade. The dark colour is due to ferrous oxide. The sample examined was numbered VS 502.

	Per cent.
Silica	54·28
Alumina	19·63
Ferric oxide	nil
Ferrous oxide	8·70
Manganese oxide	0·13
Lime	9·63
Magnesia	4·39
Alkalies	3·43
Water	nil
Carbonic acid	nil
Phosphoric acid	nil
Total	100·19

[1] Cf. the ornamentation of the fluted bone bracelets from Knossos (16th cent. B.C.). Evans, *Palace of Minos, III*, p. 409, fig. 271.

[2] It is still uncertain whether the more roughly made specimens are not jar-stands.

Rarely, these bracelets are inscribed with one or two pictographs, which may be either the name of the maker or of the owner. The characters are always so minute that it is difficult to see them at all.

Pictographs.

Shell bracelets like that illustrated in Pl. CLII, 2 (L 404), which measures 2·25 inches in diameter by 1 inch wide and 0·12 inch thick, are often found. They were roughly cut from large *śank* shells, the columella being first removed and the shell then sawn into sections. Beyond smoothing the edges of the cuts and removing the saw-marks, no further attempt was made in the majority of these bracelets either to round or to ornament them. None the less, despite this lack of finish, they are quite presentable objects, which probably accounts for their great popularity at all periods.[1] Similar bracelets are favoured ornaments in Bengal at the present day, but they are better finished and sometimes engraved. The illustrated specimen was found in Room 89, Block 9, L Area. It dates from the Late Period.

Shell bracelets.

That a great number of these or similar bracelets were worn on one arm is proved from the little bronze statuette shown in Pl. XCIV, 6, 7, and 8. The armlets worn by this dancing girl were probably made of shell or similar light material, since metal would have proved much too heavy.[2]

Hair-Pins and Hair-Pin Heads (Pl. CLVIII, 1–6, 8–11, and 13)

Not a single pin that can be definitely called a hair-pin has yet been found at Mohenjo-daro. We have, however, sure evidence that they were sometimes worn in the fact that a hair-pin with a short shaft and a plain round head is carved on the back of the sculptured head pictured in Pl. XCIX, 6, and that various pieces of carved stone, ivory, and shell would seem, in some cases certainly, to be pin-heads. The head of the statue that is shown wearing a pin is that of a man, which proves beyond doubt that, as in ancient Sumer, men as well as women were accustomed to use these articles.

Rarity of pins.

The absence of hair-pins is somewhat difficult to explain, for objects of this nature are very frequently lost owing to their liability to slip from the head. A possible explanation is that they were mainly made of wood, which could not have survived the damp and salty soil of Mohenjo-daro.

Possibly made of wood.

No. 1 in Pl. CLVIII (VS 2041) must be the top of a hair-pin. This now measures 1·3 inches high and is made of ivory. The animal apparently represents an ibex, but the horns are broken off. Level, 3 feet below surface. Room 23, House IX, Block 2, VS Area.

Hair-pin heads.

No. 2 (HR 1279) is 0·6 inch high by 0·85 inch in diameter. It is made of steatite. A deep hole in its base is 0·25 inch in diameter. There is a design carved on the sides of the head similar to that on handle No. 17 in Pl. CXXXII, but the wavy pattern is not so compressed. On the top of the head is another design similar to the pattern shown in Pl. CLV, 48 and 49. Level, 9 feet below surface. North-east corner of House III, Block 2, Section A, HR Area.

No. 4 (HR 6097) measures 0·8 inch in diameter by 0·55 inch high. It is made of a vitreous paste, bluish-green in colour. There is a small hole in its base to affix it to a copper pin. Level, 10 feet below surface. House XLI, Block 5, Section B, HR Area.

No. 6 (HR 6216) is 0·8 inch in diameter and 0·45 inch high. Faience or vitreous paste of a light blue colour. Small hole in base. Level, 6 feet below surface. House XLI, Block 5, Section B, HR Area.

[1] For similar types, see Petrie, *Predynastic Egypt*, pl. xxxi, figs. 21 and 27.

[2] I have seen, however, Indian dancing-girls with a score or more of silver and gold bracelets on their arms. Such bracelets are commonly made of thin metal, with or without a core of lac, and need not be unduly heavy.—[Ed.]

Both Nos. 4 and 6 are imitations of the capsules of some variety of lotus or water-lily.

No. 5 (HR 1053) is a pin-head carved into the form of three monkeys clasping one another around the shoulders. It is 0·65 inch high and 0·6 inch in diameter, and is made of steatite. The hole in its centre which runs right through the head is 0·15 inch in diameter. This motif was a favourite one in Egypt in the twelfth dynasty, where two or more monkeys are shown around the sides of kohl-jars. Level, 8 feet below surface. Found in Chamber 22, House III, Block 2, HR Area.

No. 8 (HR 2861) is a round head, 1·2 inches in diameter. The material is limestone. The face of this globular head has been irregularly drilled with depressions of varying size, each of which has a smaller depression at its base. Some of the larger depressions engage one another, forming an irregular trefoil pattern. It was evidently intended to fill in these depressions with a coloured paste. Level, 3 ft. 6 in. below surface. First Street, HR Area.

No. 9 (DK 2546) is flat on one side and rounded on the other. The edge is notched. This pin-head measures 1·12 inches in diameter and 0·23 inch thick. Material, pottery. Level, 6 ft. 6 in. East of Room 7, Block 2, Section B, DK Area.

No. 10 on Pl. CLVII (HR 5467) is made of steatite. It is 1·2 inches in diameter by 0·65 inch high. Its base is flat. The upper part of the object bears a carved design similar to Nos. 48 and 49 in Pl. CLV. There is a hole through its centre, 0·2 inch in diameter. Owing to the large size of this object there is some doubt whether it was a pin-head. It may possibly be a spindle-whorl. Level, 4 feet below surface. Room 85, House IX, Block 2, HR Area.

No. 11 (SD 233) measures 0·97 inch high and 0·91 inch in diameter. A hole running right through its centre is 0·1 inch in diameter. The material is baked clay. Four vertical grooves adorn the sides. Level, 5 feet below surface. SD Area.

No. 13 (E 1348) is a plain head cut from a piece of shell; it measures 0·7 inch high. In its base is a deep hole measuring 0·15 inch in diameter. Trial trench E, DK Area.

Combs (Pl. CXXXII, 13 and 21 ; Pl. CXXXIV, 4)

Specimens rare.

Combs have been included under Personal Ornaments for the reason that they were probably worn in the hair. Only two examples have been found at Mohenjo-daro, possibly for the reason that the majority of combs were made of wood.

No. 13 in Pl. CXXXII (HR 5870) is also illustrated in Pl. CXXXIV, 4. It is fairly well preserved and measures 1·3 inches long by 0·8 inch wide and 0·15 inch thick. It is decorated on both sides with concentric circles filled in with a black pigment. As it was found 2 feet below the surface of the ground, it clearly belongs to the Late Period. Room 32, House VI, Block 2, Section B, HR Area.

No. 21 in Pl. CXXXII (C 2165), which was found in the DK Area, is made of ivory and measures 1·65 inches high and 0·14 inch thick. It has been badly burnt and blackened. Both ends are missing. Level, 8 feet below surface. Room 5, Block 8, Section C, DK Area.

Use by both sexes.

Doubtless combs were used by both the men and women of Mohenjo-daro, as at the present day in India ; for we know from more than one of the statues (Pl. XCIX) that the Indus Valley folk wore their hair long. Of the combs found none are complete, but the top of No. 21 has a well-polished, bevelled edge, and is sufficiently well preserved to show that it had only a single row of teeth.

Buttons ? (Pl. CXLIII, 19 ; Pl. CLV, 5–7)

A number of dome-shaped copper objects (HR 6186), measuring 0·7 inch in diameter, appear to be buttons (Pl. CXLIII, 19). Each was evidently beaten into a dome 0·2 inch high, and then a small portion of the top of the dome was pressed in to form a projection on the inside. This projection was then pierced, so that the object could be sewn on to the clothing. Besides being used as buttons, these objects could also have been used to ornament a dress, and, if applied thickly enough, would have served the purpose of scale armour. Indeed, from the number that were found in the same place and the regularity of their size, one is inclined to surmise that they were perhaps mainly used either for ornamentation or for the making of armour. Level, 8 feet below surface. From Chamber 107, House XII, Block 2, HR Area. Intermediate Period.

Together with these supposed buttons smaller dome-shaped pieces of copper have been found with a plain rounded top. Each measures 0·5 inch in diameter and 0·25 inch high, and has a minute hole pierced close to the edge on either side.

Faience buttons.

Buttons made of faience are illustrated in Pl. CLV, 5–7.

No. 5 (HR 955) measures 1·45 inches in diameter and, including the knob, is 0·42 inch thick. Its glaze still bears traces of its original blue or green colour. An eye for attaching the button to the clothing was made in the centre of its flat base by roughly scooping out a depression and bridging it over with a strip of paste. This was a very clumsy method of making an eye, and I am inclined to think that perhaps this particular object was used solely as a dress ornament. The bridge across the aperture in the base of this object could stand but little pulling or hard wear. From south-west corner of House I, Block 1, Section A, HR Area. Level, 4 feet below surface.

No. 6 (HR 665) is made more simply. It has a flat base and slightly rounded top, and measures 1 inch in diameter by 0·2 inch thick. A loop for the thread was made by boring two small holes that meet one another obliquely in the middle of the base.[1, 2] Level, 3 ft. 6 in. below surface. Chamber 3 or 4, House I, Block 1, Section A, HR Area.

No. 7 (DK 1506) is 1 inch in diameter, with a flat base and a rounded top with a little knob in its centre. The eye, formed by two converging holes, is in the middle of the base. Level, 5 feet below surface. Room 9, Block 2, Section C, DK Area.

Bullæ (Pl. CXXXIII, 1–3)

Three very curious pendants have been found at Mohenjo-daro, all of which are made of pottery.

Pierced pottery roundels.

No. 1 in Pl. CXXXIII (C 2750) is triangular in shape and measures 2·35 inches long by 0·25 inch thick. The lower portion of the ornament is pierced with a double row of small holes, but whether the holes in this particular object are for the purpose of decoration or for attaching the object to a garment, it is difficult to say. Level, 3 feet below surface. Room 1, Block 2, Section C, DK Area.

No. 2 (VS 1054) is a circular object measuring 1·65 inches in diameter and 0·18 inch thick. It is ornamented by a double row of fine pittings that, however, do not penetrate right through the object as in the case of the first. Its obverse surface is very slightly

[1] Pumpelly, *Explorations in Turkestan* (1904), vol. i, p. 162; fig. 338.

[2] Buttons with V-shaped perforations are known in the Danubian civilization and the Chalcolithic civilizations of Portugal and Spain.

rounded, and the back is flat. Level, 3 ft. 6 in. below surface. Vicinity of the S.W. corner of House XXVI, Block 4, VS Area.

No. 3 (VS 1447) is 1·5 inches in diameter and 0·2 inch thick. Its surface is flat and its back slightly rounded. The face is decorated in rather an irregular manner with pittings. Of particular interest is the strip of clay that has been placed across the face of the object at the top, evidently with the idea of preventing the suspension holes from tearing owing to the thinness of the ornament. Level, 2 feet below surface of ground. House XXX, VS Area.

All three objects are hand-made and are of somewhat rough workmanship, none being coated with a slip or possessing any trace of colour. They could hardly have been worn solely as ornaments, and must have had a special purpose.

Copies of leather cases.

These objects have all the appearance of being copies of stitched leather cases, and it is possible that originally similar cases, made of leather, were used to enclose amulets. Later on, perhaps, the cases themselves came to be regarded as more important than their contents, and subsequently were copied in pottery.[1]

Appendix

Determination of Beads from Mohenjo-daro

I. Introduction

Density.

The chief physical property employed in the determination of the beads described below was that of density. As it was considered of value and interest from a scientific as well as from an archæological standpoint, the determination of the densities was made with extreme accuracy. The beads were weighed in air suspended by a fine platinum wire composed of two pieces which hooked into each other. The weight of this wire in air and suspended in distilled water to a certain mark was previously noted. It is worthy of remark that the weight of the suspending wire in water (0·1667 grammes) was more than its weight in air (0·1654 grammes) on account of the surface tension of the water acting on the wire.

Each bead was suspended in water to the same mark on the platinum wire by means of a glass rod placed across the beaker. Distilled water was used in all cases and the level of the water in the beaker was kept constant. To ensure that no air bubbles adhered to the surface of beads, the beaker, containing the bead suspended as above, was placed in a large glass jar and the air removed by means of a Fleuss Vacuum pump to a pressure varying between 1·5 and 1·8 cm. of mercury. This usually involved the exhaustion being prolonged for fifteen minutes, as it was found that all air bubbles were not removed under this period.

Air was again admitted to the large glass jar and the beaker removed and placed on a convenient stand over one pan of a chemical balance. The platinum wire suspending the bead was gripped by forceps and the glass rod removed ; then the suspending wire was hooked to the other wire which had remained suspended from the balance.

The weight of the bead suspended in water to a fixed mark on the platinum wire was then determined, and the temperature of the water taken.

[1] Compare with these some gold and silver ornaments from Susa, dated to the time of Dungi (about 2278–2170 B.C.), the embossing on some of which also suggests stitched leather. *Mém. Dél. en Perse*, t. vii, pl. xii, p. 69.

The densities were then obtained by means of the following expression :—

$$\frac{\text{weight of solid in air}}{\text{weight of solid in air} - \text{weight of solid in water}}$$

These values required correction for the buoyancy of air and for the deviation, from standard (unit) value, of the water density at the temperature of the weighing.

Let d = the approximate value of the density of the solid as obtained in this way.
D = the true density of the solid.
d_W = the density of distilled water at the temperature of the weighing.
δ = the density of the air at the time of the weighing in air.
Then $D = d_W (d - \delta) + \delta$ [1]

i.e. the correction to be applied to the approximate value, d, in order to obtain the true value, D, of the density of the solid is

$$D - d = d\,(d_W - \delta - 1) + \delta$$

In actual practice, determinations of the density were made at temperatures between 18·5° and 26·5° C. Corrections for temperatures up to 25° C. were obtained from Glazebrook, and for temperatures higher than 25° C. by extrapolation beyond the tables given by Glazebrook. Thus the densities given in the following section are all true densities and are thus strictly comparable. The limit of error may be taken as + ·002. The largest correction made to the approximate densities was — ·05 for the gold bead *j* 19. A correction of — ·014 was made for the densities of beads *g* 15 (26·5° C.) and *j* 15 (24° C.). The smallest correction was — ·005 for beads *i* 43 and *i* 41 (18·5° C.).

Other physical properties employed.

Colour, hardness, and action upon light were also employed as means of identification. On account of the great value of the beads, it was not possible to break off fragments and then employ the usual optical methods adopted in the identification of unknown minerals. In a few cases, however, a few fractions of a milligramme of a bead were detached by means of a small bit very carefully turned by hand in the core of the bead. The refractive indices of the extremely minute fragments were then determined by comparison with liquids of known refractivity (determined by means of the Abbé refractometer) by use of the Becké line test.

Dr. W. A. K. Christie has been kind enough to perform certain microchemical tests upon, and optical determinations of, some of the beads in string *j*, and to him, also, is due the determination of the refractive index of the jade beads in string *i*.

Nomenclature.

The nomenclature adopted by Bauer and Spencer (*Precious Stones*, 1904) has been followed as far as was possible. In the description which follows, the numbers of the beads are those beginning from the numbered end of each string. The weight of each bead in air is given, as this is considered to be of interest.

The references given after specific colours refer to plates in Ridgway's useful book on colours (*Color Standards and Nomenclature*, by R. Ridgway, Washington, 1912).

[1] R. Glazebrook, *Dictionary of Applied Physics*, iii, 1923, p. 132.

II. Determination of the Beads

Table of weights and densities. String g.

HR 4212 A. (Pl. CL, String *g*, Nos. 1–29)

Number.	*Weight in air in grammes.*	*True Density.*	*Determination.*
1	1·5056	2·561	Riband-jasper.
2	1·7828	2·549	Riband-jasper.
3	1·8268	2·616	Agate.
4	1·4620	2·608	Agate.
5	2·5182	2·658	Red jasper.
6	2·2035	2·623	Agate-jasper.
7	3·1348	2·551	Riband-jasper.
8	1·9578	2·597	Agate.
9	3·1469	2·657	Red jasper.
10	2·1496	2·574	Agate.
11	2·4880	2·534	Onyx.
12	2·4570	2·192	Blue jasper.
13	4·5597	2·598	Chalcedony.
14	3·6725	2·639	Red jasper.
15	7·6433	3·343	Jade.
16	5·6586	2·761	Jasper.
17	4·2693	2·579	Moss-agate.
18	2·7017	2·594	Agate.
19	2·9555 [1]	2·697 [1]	Amazon ſtone.
20	2·1148	2·661	Riband-jasper.
21	3·8876	2·657	Red jasper.
22	1·9796	2·607	Agate.
23	2·6583	2·596	Moss-agate.
24	1·8786	2·616	Riband-jasper.
25	2·4036	2·663	Red jasper.
26	1·9006	2·573	Agate.
27	2·4860	2·528	Riband-jasper.
28	1·9116	2·548	Riband-jasper.
29	0·8405	2·569	Agate-jasper.

Notes.

This ſtring (*g*) is moſtly composed of agate and jasper beads. They have been arranged by the excavators more or less symmetrically on either side of bead 15, which is a lettuce green (V, 29, *k*) jade bead ; thus, bead 9 corresponds to 21 and 5 to 25, all being red (claret-brown : I, 5, *m*) jaspers ; 8 corresponds to 22, both being agates ; and 2 corresponds with 28, both being riband-jaspers (mouse-grey : LI, 15'''', —, and cinnamon : XXIX, 15'', —).

In addition to the jade mentioned above, there is but one representative in this ſtring of the following ſtones : onyx, chalcedony, and amazon ſtone. The chalcedony is pale orange citrine (IV, 19, *k*), whilſt the amazon ſtone is light sulphate green (XIX, 39', *b*) and white in colour. The latter ſtone was unfortunately in a cracked condition.

[1] This bead has a metallic-looking core and hence its high density.

Beads 5, 9, 14, 21, and 25 appear to have been cut from the same jasper stone, their densities being 2·658, 2·657, 2·639, 2·657, and 2·663, respectively. The skill of the lapidary is well exhibited in the way in which these stones have been cut so as to show white bands of quartz on the claret-brown (I, 5, *m*) background; also beads 2 and 28 show central mouse-grey (LI, 15'''', —) bands with terminal cinnamon (XXIX, 15'', —) bands. The two agates 3 and 4 are probably made from the same stone (densities 2·616 and 2·608 respectively), and have been beautifully cut so that the white bands pass in a parallel manner across one side of each bead, the general colour of the stones being slightly darker than buckthorn brown (XV, 17', *i*); they are similar to the "Pagoda stones" or agates from Burma. On the reverse side of bead 3 there are visible a few bands which just come to the surface.

Bead 8 is also an agate which shows a series of white bands encircling a vandyke brown (XXVIII, 11'', *m*) bead. Bead 22 is a fine specimen of agate which has been cut so that the white bands which, in the natural stone, would be in the form of a spheroidal mass, now encircle the bead, being apart on one side and meeting on the reverse side. The stone has thus been cut across the base of the banded spheroid.

The moss-agates, 17 and 23, have both been cut to show an oval aggregation of green (nearest colour: meadow green, VI, 35, *k*) enclosures in a white oval band on paler chalcedonic masses.

The agate bead, 18, which is of the riband-agate type, shows a fine "mitre" pattern on one surface and the onyx bead, 11, shows concentric white bands on a black stone.

With reference to the riband-jaspers 1 and 27, the lapidary has so cut the beads that they exhibit two cross-bandings which form a cross-hatching, more conspicuously displayed on the latter bead.

In addition to the stones specifically mentioned above, one could enthuse over most of the remainder; but enough has been written to indicate that the lapidary had brought his art to a high state of perfection in the days when the city of Mohenjo-daro was flourishing. All the beads possess a high polish and are in an excellent state of preservation.

Table of weights and densities. String *h*.

HR 4212 A. (Pl. CL, String *h*, Nos. 1–38)

Number.	*Weight in air in grammes.*	*True Density.*	*Determination.*
1	0·8712	2·626	Heliotrope.
2	0·5327	2·624	Heliotrope.
3	0·6573	2·612	Plasma.
4	0·5180	2·611	Agate-jasper.
5	0·9651	2·587	Riband-jasper.
6	0·8334	2·604	Riband-jasper.
7	0·8576	2·534	Yellow jasper.
8	1·4504	2·612	Agate-jasper.
9	1·3331	2·557	Riband-jasper.
10	1·7065	2·587	Agate-jasper.
11	2·5751	3·027	Lapis-lazuli.
12	2·1811	2·796	Riband-jasper.
13	1·7948	2·616	Riband-jasper.
14	2·4703	2·931	Riband-jasper.
15	1·8828	2·681	Jasper.
16	2·2028	2·546	Riband-jasper.

Number.	Weight in air in grammes.	True Density.	Determination.
17	2·5271	2·627	Riband-jasper.
18	3·0418	2·582	Agate.
19	2·6951	2·643	Riband-jasper.
20	3·6536	2·623	Heliotrope.
21	2·7487	2·586	Riband-jasper.
22	2·3331	2·523	Riband-jasper.
23	1·8094	2·559	Riband-jasper.
24	2·5264	2·516	Riband-jasper.
25	1·9121	2·666	Jasper.
26	2·5460	2·573	Riband-jasper.
27	2·4497	3·058	Tachylite.
28	2·0951	2·605	Agate-jasper.
29	2·6245	3·016	Lapis-lazuli.
30	1·8971	2·682	Riband-jasper.
31	2·0483	2·546	Riband-jasper.
32	1·4790	2·843	Riband-jasper.
33	0·6848	2·582	Riband-jasper.
34	1·3245	2·728	Jasper.
35	0·7448	2·486	Agate-jasper.
36	0·8023	2·824	Riband-jasper.
37	0·5075	2·622	Riband-jasper.
38	0·4168	2·669	Red jasper.

Notes.

String *h*, also, has been arranged more or less symmetrically around a heliotrope bead (20). Sometimes this symmetry is due to the beads being of the same shape though of different stones, as, e.g. 19 and 21, 13 and 27, 10 and 30; but in other cases the stones correspond, as e.g. 11 and 29, which are both lapis-lazuli, 15 and 25, and 14 and 26, which are pairs of similar jaspers.

This string is chiefly composed of jasper beads which vary greatly in colour. Most of them are banded varieties and the full beauty of the bands is invariably displayed. Particularly noticeable are the beads 15 and 25, most likely cut from the same stone, and bead 16, in which there is a fine range of colours. A double set of markings similar to those on *g* 1 and *g* 27 is again exhibited on *h* 9.

There is but one representative of true agate, 18, and of plasma, 3; also the peculiar bead 27, which is most probably an ultrabasic rock, has none other like it.

The beads forming this string are generally well preserved, but some are rather badly chipped.

Table of weights and densities. String *i*.

HR 4212 A. (Pl. CL, String *i*, Nos. 1–43)

Number.	Weight in air in grammes.	True Density.	Determination.
1	0·5636	2·597	Moss-agate.
2	0·5920	3·225	Jade.
3	0·5611	2·601	Carnelian.
4	0·8323	3·319	Jade.
5	0·4299	2·604	Agate.

Number.	*Weight in air in grammes.*	*True Density.*	*Determination.*
6	1·4367	3·355	Jade.
7	0·7546	2·655	Red jasper.
8	1·0203	3·346	Jade.
9	0·9184	2·600	Agate.
10	0·9015	3·353	Jade.
11	1·1260	2·594	Chalcedony.
12	0·8132	3·354	Jade.
13	1·6820	2·606	Chalcedony.
14	1·0611	3·382	Jade.
15	1·2639	2·575	Agate.
16	0·9758	3·311	Jade.
17	1·7354	2·61	Agate.
18	2·7962	3·395	Jade.
19	2·2970	2·544	Carnelian.
20	4·7317	3·314	Jade.
21	4·0480	2·614	Chalcedony.
22	4·8003	3·365	Jade.
23	2·6274	2·611	Chalcedony.
24	3·8166	3·314	Jade.
25	1·6720	2·613	Agate.
26	2·2731	3·322	Jade.
27	2·3116	2·598	Agate.
28	0·9902	3·312	Jade.
29	1·9049	2·612	Agate.
30	1·4406	3·358	Jade.
31	1·6571	2·586	Agate.
32	0·7704	3·342	Jade.
33	1·3146	2·618	Chalcedony.
34	1·1896	3·342	Jade.
35	0·7998	2·626	Agate.
36	0·9438	3·351	Jade.
37	Density not taken as bead is encrusted with calcite.		Red jasper.
38	0·8531	3·353	Jade.
39	0·5824	2·593	Agate.
40	0·9976	3·347	Jade.
41	0·4894	2·608	Chalcedony.
42	0·7088	3·364	Jade.
43	0·3286	2·593	Agate.

Notes.

String *i* is the most beautiful of the four strings of beads. It consists of alternate beads of a peculiar jade with, most commonly, agate or chalcedony beads separating them. The soft green colour of the jade shades through many tints from cerro green (V, 27, *m*) to lettuce green (V, 29, *k*) and almost to a lumière green (XVII, 29′, *b*) or a chrysolite green (XXXI, 27″, *b*) with even lighter coloured patches. The commonest shade is a light lettuce green, and this blends harmoniously with the prevailing buckthorn brown (XV, 17′, *i*) and yellow ochre (XV, 17′, —) tints of the chalcedony beads.

The beads have also been arranged symmetrically on either side of the jade bead 22; thus, pairing the stones, we have 21 and 23, 11 and 33, all of which are chalcedony; 17 and 27, 15 and 29, 9 and 35, and 5 and 39, all of which are agates; and 7 and 37, both of which are jasper beads. The beads are well matched in size and shape and they diminish in size more or less uniformly towards either end.

The most outstanding beads are two carnelians, 3 and 19, the latter being a fine large specimen. Their colour is between Brazil red (I, 5, *i*) and English red (II, 7, *i*).

There is a single moss-agate bead, 1, which commences the string.

All the beads possess a remarkably fine polish, and again great skill has been displayed in their cutting.

Table of weights and densities. String *j*.

HR 4212 A. (Pl. CL, String *j*, Nos. 1–39)

Number.	*Weight in air in grammes.*	*True Density.*	*Determination.*
1	0·7425	2·098	Nepheline-sodalite-rock.
2	0·4256	2·635	Red jasper.
3	0·4887	2·730	Riband-jasper.
4	0·5231	2·566	Agate-jasper.
5	0·7569	2·586	Agate.
6	0·6372	2·593	Agate-jasper.
7	0·9532	2·602	Heliotrope.
8	1·5776	2·645	Jasper.
9	1·3899	2·671	Plasma.
10	2·8371	2·587	Riband-jasper.
11	2·1104	2·675	Variegated green jasper.
12	2·2356	2·435	Jasper.
13	1·8376	2·575	Moss-agate.
14	3·2065	2·594	Riband-jasper.
15	0·239	3·9	Silver.
16	3·3307	2·782	Lapis-lazuli.
17	Density not determined.		Silver.
18	1·7360	2·624	Jasper.
19	Density not determined.		Silver.
	0·1663	14·23	Gold.[1]
20	6·0476	2·993	Lapis-lazuli.
21	Density not determined.		Silver.
22	1·8978	2·574	Agate.
23	Density not determined.		Silver.
24	2·8954	2·993	Lapis-lazuli.
25	Density not determined.		Silver.
26	1·6840	2·552	Riband-jasper.
27	3·5212	2·943	Lapis-lazuli.
28	1·6497	2·626	Jasper.
29	1·6094	2·564	Green jasper.
30	2·9658	2·626	Heliotrope.

[1] This is a bead that was found inside the silver bead.

Number.	*Weight in air in grammes.*	*True Density.*	*Determination.*
31	1·5323	2·613	Heliotrope.
32	0·8860	2·620	Agate-jasper.
33	0·9604	2·647	Jasper.
34	0·9036	2·655	Plasma.
35	0·5124	2·596	Agate.
36	0·6559	2·604	Riband-jasper.
37	0·5882	2·608	Agate.
38	0·4198	2·560	Riband-jasper.
39	0·2711	2·440	Nepheline-sodalite-rock.

Notes.

String *j* is in many ways the most interesting of the four strings of beads, and was undoubtedly much handsomer at the time when it was worn than it is to-day.

The silver beads have become ugly and brittle, through the formation of silver chloride; the lapis-lazuli beads have lost much of the brilliant azurite blue (IX, 53, *m*) they must originally have possessed, if they resembled the fresh Badakshān lapis-lazuli; and also the first and last beads, as will be seen later, have lost much of their original beauty.

A small gold bead was found inside the silver bead 19.

Bead (DK 1341). From Necklace (No. 6) illustrated in Pl. CXLVIII, *a*.

Weight in air in grammes	4·5296
True density	3·356
Determination	Jade

III. Descriptive Notes

1. *Jade*

The following beads have been identified as jade: Pl. CL: *g* 15; *i* 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42; and a bead from necklace No. 6 in Pl. CXLVIII, *a*. The average density of these twenty-three beads is 3·340, the range of their density being from 3·225 (*i* 2) to 3·395 (*i* 18). There is, however, but one bead with a density less than 3·311, and there are only two with densities greater than 3·365.

The variation in colour of the beads has already been noticed (p. 539). No pleochroism was observable in the beads when held in a Feuss dichroscope, and, on account of the absence of plane faces, efforts to obtain the refractive indices of the beads by means of a Herbert Smith refractometer proved unavailing. Accordingly extremely minute fragments of one of the beads were detached by the method previously described (p. 535).

The mean refractive index of bead *i* 42 was determined as $1{\cdot}651 \pm {\cdot}002$, and its birefringence is less than ·005.

The hardness of beads *i* 42 and *DK* 1341 was determined as 7·5.

The name "jade" is loosely applied to two different minerals, one nephrite, which is an amphibole, and the other jadeite, which is a pyroxene. Dana gives the hardness and density of nephrite as $h = 6\text{–}6{\cdot}5$, $g = 2{\cdot}96\text{–}3{\cdot}1$, and of jadeite as $h = 6{\cdot}5\text{–}7$, $g = 3{\cdot}33\text{–}3{\cdot}35$ respectively.

Larsen,[1] no doubt following Michel Levy and Lacroix, gives the mean refractive index of jadeite as $\beta = 1{\cdot}654$, and its birefringence as $B = {\cdot}029$.

[1] *United States Geological Survey, Bull.* 679, p. 220.

The hardnesses, densities, and refractive indices of such specimens of jade as were available in the collections of the Geological Survey of India were determined as under :—

	Hardness.	*Density.*	*Refractive Index.*
I	7·5	3·336	β 1·651 ± ·002
II	7·5	3·326	β 1·651 ± ·002
III	7·5	3·324	β 1·65 ± ·004
IV	6·5	2·98	Between 1·575 and 1·590
V	5·5	2·582	—
VI	6·5	3·088	—

I. Chinese jade (M 1645), presented by the British Museum.
II. Burmese jade, collected by Dr. J. Coggin Brown and presented to Dr. W. A. K. Christie.
III. Jade, from Uru river, Upper Burma (I 716).
IV. Jade, from near Belakchi, Kārākāsh valley, South Turkestān (M 1384), collected by F. Stoliczka.
V. Jade (? bowenite), from Kābul, Afghānistān (G 321).
VI. Jade, from Mirzāpur District, United Provinces, India (G 319).

(Numbers in parentheses refer to the registers of the Geological Survey of India.)

It is interesting to note that the average density of the five specimens of jade from Burma which were analysed by Bleeck [1] is 3·335.

Considering the results given above, one notes that, though the mean refractive index (1·651) and birefringence (less than ·005) of the bead *i* 42 differ from those usually given for jadeite (1·654 and ·029), yet the figures obtained are in agreement with those of samples of Burmese and Chinese jade.

The yellowish-green colour of the beads might suggest them to be peridots ; and they are more translucent than most varieties of jade. However, the refractive indices of olivine (1·661–1·697) and birefringence (·036) differ widely from those of the beads, and it appears certain that the beads are made of a peculiar form of jade, which, in all probability, was obtained from China or Burma.[2]

2. *Lapis-lazuli*

The six beads (*h* 11, 29 ; *j* 16, 20, 24, 27) determined as lapis-lazuli have an average density of 2·959. They are generally navy-blue (XXI, 53′, *m*) in colour, though originally they were probably azurite blue (IX, 53, *m*).

Lapis-lazuli is the name loosely given to the mineral lazurite, the silicate and sulphide of sodium and aluminium, the density of which is given by Dana as 2·38–2·45. It must be remembered, however, that lapis-lazuli is a rock, inasmuch as it may contain in addition to lazurite or hauynite (sometimes changed to a zeolite) the following minerals : a diopside free from iron, amphibole (koksharovite), mica (muscovite), calcite, pyrite ; also in some varieties a relatively small amount of scapolite, plagioclase, orthoclase, apatite, titanite, zircon, and an undetermined mineral.

The high density inclines one to the view that the beads under examination were probably lazulite, the hydrous ferro-magnesian and aluminous phosphate, the density of which is given by Dana as 3·057–3·122. As the variation in density of the beads under examination was large, minute fragments were detached from the cores of beads *j* 16 and *j* 24.

[1] *Rec. Geol. Surv. Ind.*, xxxvi, 1907, p. 274.
[2] Cf. however, pp. 683–4 *infra*.—[Ed]

It was at once seen that several minerals made up the beads. Lazurite was present ; it was isotropic and azure-blue in the thinnest section, and possessed a refractive index of 1·494 ± ·003. There were, in addition, at least three other minerals ; one with $n\beta$ less than 1·596 but greater than 1·573 ; another with $n\beta$ greater than 1·596 ; and a third with refractive indices lying between 1·543 and 1·520. For fear of damaging the beads, the precise determination of these minerals could not be proceeded with ; but it is quite possible that the mineral with the high refractive index is the one possessing a high density which is at least more than 3. It is suggested that this mineral might be diopside, the refractive indices of which are given by Larsen as 1·673–1·680, and whose density is 3·2–3·38.

Microscopic examination of the beads shows abundant patches of a creamy-white mineral which varies in amount in individual beads. In view of the remarks above, it is more than likely that there are several such white minerals present. In addition, pyrite can be seen though most of this mineral appears to have been worn off the surfaces of the beads.

Ball[1] describes the occurrence of lapis-lazuli in Badakshān. A specimen in the collections of the Geological Survey of India (M 730) was examined and the lazurite in it found to have the refractive index of 1·494 ± ·003. This mineral was associated with diopside, calcite, and pyrite.

Thus it appears extremely likely that the source of the lapis-lazuli found at Mohenjo-daro was Badakshān.

(As an additional check upon the determination of lazurite, the refractive indices and density of lazulite from Gulābgarh, Padar district, Kashmīr, which is in the collections of the Geological Survey of India (I 35) were determined to be between 1·610 and 1·646 and as 3·179 respectively.)

3. *Gold*

Inside one of the silver beads (*j* 19), and loose, was a bead of gold spherical in shape, both outside and in (3·9 mm. in diameter and 3·0 mm. long, with circular openings of 1·4 mm. diameter). The diameter of the gold bead very nearly coincided with that of the aperture of the silver bead. This gold bead was found to have a density of 14·3, which is below the limits given by Dana (15·6 – 19·3). Hintze,[2] however, records the following occurrences of native gold with a density about 14 :—

		Density.	*Silver. Per cent.*
I.	Verespatak	13·82	28·0
II.	Malpaso	14·706	11·76
III.	Rio Sucio	14·690	12·06
IV.	Santa Rosa de Osos . .	14·149	35·07
V.	California	14·60	8·80
VI.	West Africa . . .	14·63	10·07
VII.	Marmato	12·67	26·48

It is presumed that there is a large percentage of silver with the gold, as this will partly account for the low density.

[1] *Geology of India*, iii : *Economic Geology*, pp. 528–30.
[2] *Handbuch der Mineralogie*, I, i, pp. 313–19 (1904).

4. *Agate, Agate-Jasper and Moss-Agate*

Agate is the most important variety of chalcedony ; it is built up of layers which differ conspicuously from each other in colour and transparency.

Bauer[1] defines agate-jasper as stones which are intermediate in character between jasper and chalcedony, and which usually show opaque, dark-coloured portions intermixed in various ways with translucent, lighter-coloured portions. In actual practice it is very hard to define the border-line types.

Moss-agates are characterized by the presence of green enclosures, which usually take the form of long hairs and fibres much intertwined, and have the general appearance of a piece of moss.

The following beads were determined as agate : *g* 3, 4, 8, 10, 18, 22, 26 ; *h* 18 ; *i* 5, 9, 15, 17, 25, 27, 29, 31, 35, 39, 43 ; *j* 5, 22, 35, 37. They range in density from 2·573–2·626, the average density of the twenty-three beads being 2·597.

Ten beads were determined as agate-jasper, viz.: *g* 6, 29 ; *h* 4, 8, 10, 28, 35 ; *j* 4, 6, 32. These ranged in density from 2·486–2·623, their average density being 2·587.

The four following beads were identified as moss-agate, viz. : *g* 17, 23 ; *i* 1, *j* 13. They ranged in density from 2·579 to 2·597, the average density being 2·591.

The thirty-seven beads mentioned above present a wonderful variety of colours, and in all instances they still possess a high polish.

5. *Chalcedony*

The following beads have been determined as common chalcedony or chalcedony in the more restricted sense of being white or some very pale shade of grey, yellow, brown, blue, or green, and uniformly coloured : *g* 13 ; *i* 11, 13, 21, 23, 33, 41.

Their density ranges from 2·594 (*i* 11)–2·618 (*i* 33) and their average density is 2·607. The greatest departure from the average density is 0·5 per cent.

The beads are various shades of yellow in colour, e.g. buckthorn-brown (XV, 17′, *i*), yellow ochre (XV, 17′, —), and pale orange citrine (IV, 19, *k*).

6. *Carnelian*

Only two beads are carnelian or red chalcedony, viz.: *i* 3 and *i* 19. As noted before, the colour of these beads is between Brazil red (I, 5, *i*) and English red (II, 7, *i*). Their respective densities are 2·601 and 2·544.

The large bead shows fracture lines which have probably been induced in the past by some hard blow or blows upon the bead.

7. *Heliotrope*

Heliotrope, or blood-stone, differs from plasma only in that its green colour is spotted, patched, or streaked with a fine blood-red.

The six beads which have been recognized as heliotrope (*h* 1, 2, 20 ; *j* 7, 30, 31) have densities between 2·602 and 2·626, their average density being 2·619. The finest specimens are *h* 1 and *j* 30, which show fine morocco red (I, 5, *k*) patches on a dull, blackish-green (XLI, 35‴, *m*) stone. It is interesting to note that the greatest variation in density from the average density given above is less than 1 per cent.

[1] Op. cit., p. 501.

8. *Plasma*

Plasma is the name applied to green chalcedony, the colour of which ranges from dark leek-green, the commonest shade, through pale apple-green, to almost white.

Three beads, *h* 3, *j* 9, and *j* 34, have been identified as plasma. They vary in colour from a dull greenish-black (XLVII, 33'''', *m*) to an elm-green (XVII, 27', *m*). It is of interest to note that their densities range from 2·612–2·671, the average density being 2·639.

9. *Jasper*

It will have been noticed that by far the greatest number of beads have been referred to the impure variety of massive quartz known as jasper. This is distinguished from hornstone by its large even conchoidal fracture, the dull lustre of its fractured surface and by its perfect opacity and deep colour. There is, however, no sharp line of demarcation between jasper and hornstone, or between jasper and chalcedony.

The following varieties of jasper have been distinguished :—

Common jasper : Eight beads, *g* 16 ; *h* 15, 25, 34 ; *j* 8, 18, 28, 33. The average density of these beads is 2·674. There is another jasper bead, *j* 12, which is somewhat similar in appearance to *j* 18 and *j* 28 ; this bead, however, has the very low density of 2·435, and it is thus a hydrated jasper.

Blue jasper : Another hydrated jasper noticed was the blue jasper *g* 12, which has a density of 2·192.

Red jasper : There are nine red jasper beads (*g* 5, 9, 14, 21, 25 ; *h* 38 ; *i* 7, 37 ; *j* 2), their average density being 2·654. Their colour, as has been noted before, is really claret-brown (I, 5, *m*), and they all show veins of white quartz.

Green jasper : Bead *j* 29, which has a density of 2·564, is sage-green (XLVII, 29'''', —) in colour. The variegated green jasper *j* 11 has patches of invisible green (XIX, 41', *m*), upon a light seal brown (XXXIX, 9''', *m*) background. Its density is 2·675.

Yellow jasper : The yellow jasper bead, *h* 7, which has a density of 2·534, has a predominant citrine (IV, 21, *k*) colour.

Riband-jasper : Riband-jasper has differently coloured riband-like bands, which alternate regularly with each other. The greatest number of the jasper beads in the strings under examination fall into this class, there being thirty-three so classified : *g* 1, 2, 7, 20, 24, 27, 28 ; *h* 5, 6, 9, 12, 13, 14, 16, 17, 19, 21, 22, 23, 24, 26, 30, 31, 32, 33, 36, 37 ; *j* 3, 10, 14, 26, 36, 38. Their average density is 2·618, but they range in density from 2·516 to 2·931. Space does not permit of a description of the colours of the individual riband-jasper beads ; suffice it to say that the range of colours and the beauty and shape of the beads reflect great credit upon the lapidaries responsible for their manufacture.

10. *Amazon Stone*

Only one bead, *g* 19, was identified as Amazon stone or the peculiar so-called verdigris-green microcline. The bead in question was light sulphate green (XIX, 39', *b*) in colour, and it possessed a density of 2·697.

Dana gives the density of microcline as 2·54–2·57. The high density of *g* 19 is due to a central metallic-looking core, which has been inserted inside the bead. Under the microscope a thin chip of the bead, which was unfortunately broken when received by this department, showed the usual cross-hatching of microcline when examined between crossed nicols.

Amazon stone has been recorded from Dodabetta, in the Nīlgiris,[1] and it is also said to occur at Chishoti, in the Padar district of Kashmīr.[2]

11. *Tachylite*

Bead *h* 27 has been determined as being tachylite or a basaltic or ultrabasic glass. Its density is 3·058, which falls within the limits of density of the peridotite family.

Microscopic examination of small fragments shows the bead to be chiefly composed of a brownish glass with a considerable number of minute anisotropic minerals. The refractive index of the glass was found to be 1·587 $\pm$ ·004. Its specific refractivity, when calculated from the expression $K = \frac{n - 1}{d}$ where n is the refractive index and d the density, is 0·192, assuming the density of the glass to be equal to that of the bead. This value of the specific refractivity is lower than the specific refractivity of basaltic glasses as given by Tilley[3]; but, as he states,[4] the specific refractivities of tachylites tend to be somewhat vitiated by the presence of crystallites in the glass.

12. *Silver*

The six beads, *j* 15, 17, 19, 21, 23, and 25, are made of silver. Most of the silver has been converted to silver chloride (cerargyrite or horn silver) by weathering, and not only are the beads covered inside and out with a thick, pimply coating of this mineral, but the metallic portion itself is impregnated with chloride to such an extent that it has become very brittle.[5]

In the minute quantity used for examination no other metal was found by microchemical tests after precipitation of the silver as chloride.

The fresh metal has a high lustre and a slightly yellowish tinge.

The nodular coating of silver chloride is predominantly brownish, with a greasy lustre. Its hardness is about 1. On dissolving it in ammonia, the presence of myriads of minute silver spangles is disclosed. Several green specks are also present; these were shown chemically to consist of a salt of copper. Although no copper was detected by the sensitive triple nitrite test in the metallic portion, this must originally have contained the copper found in the incrustation.

On the edge of the fractured bead, *j* 15, three distinct layers are visible, suggesting that the ornaments have been formed by beating thin sheets together. The beads are barrel-shaped, both outside and inside, and were probably hammered on a specially shaped boss.

13. *Nepheline-Sodalite-Rock*

The two beads, *j* 1 and *j* 39, which have the low densities of 2·098 and 2·440 respectively, have been determined after exhaustive tests as nepheline-sodalite-rock.

The general appearance of both beads is rather greyish, but one end of *j* 1 is distinctly pale blue in colour.

[1] H. Congreve, *Madras Jour. Lit. and Sci.*, xxii, p. 249.

[2] Verbal communication from Mr. C. S. Middlemiss.

[3] *Min. Mag.*, xcvi, March, 1922, p. 279.

[4] Op. cit., p. 287.

[5] Cf. Alexander Scott, *The Cleaning and Restoration of Museum Exhibits*, 1926, p. 22.

Microscopical examination of the material detached from the centre of the beads showed this to be largely a decomposition product ; it was soluble to a certain extent in dilute hydrochloric acid.

A small quantity was scraped out of the inside of bead *j* 1 and dried at 107° C. It weighed (on a Kuhlmann balance) 0·000271 grammes. This was treated with cold, double normal hydrochloric acid for five minutes and filtered through an Emich tube filter[1] : the residue was washed three times with distilled water, and dried at 107° C. It weighed 0·000211 grammes, showing some 22 per cent is soluble in dilute hydrochloric acid. The solution gave no precipitate with ammonia ; calcium was present in abundance ; and no magnesium was detected. As the solution in hydrochloric acid is accompanied by effervescence, it may be presumed that 20–25 per cent of the material is calcium carbonate. Fresh material does not effervesce with dilute hydrochloric acid.

The beads are both rocks, not minerals. They are very fine-grained, the average diameter of the grains of bead *j* 1 being less than 1–100th of a millimeter.

When examined under the microscope fresh material is seen to be made up of a pale yellow mineral or minerals, a pale blue mineral, and at least three colourless minerals.

One colourless mineral is isotropic and has a refractive index of 1·483 ± ·001 ; it is thus sodalite. Some, at least, of the yellow material is sodalite, it being isotropic and possessing a similar refractive index. It is thought that the pale-blue mineral is also sodalite.

Another colourless mineral had very low double refraction and a refractive index much greater than 1·539. This is probably a felspar (? andesine).

Some of the colourless material is nepheline. Its double refraction is very low, probably about ·005. The lowest refractive index found was 1·539 ± ·001, and no fragment in any orientation had an index of more than 1·543. Nepheline is uniaxial and negative in optical character. The mineral in question is doubtfully uniaxial ; no piece was found sufficiently large to give a definite uniaxial figure. One cleavage fragment was observed with positive " elongation ". As, however, the basal cleavage of nepheline is sometimes well developed, it can easily happen that a cleavage fragment of nepheline may show positive " elongation " ; this was proved experimentally for another specimen of nepheline.

Thus one can safely infer that the beads under examination are made of nepheline-sodalite-rock.

As an additional check upon this determination, a specimen of elaeolite-sodalite-syenite from Kishangarh, Rājputāna (No. 4675 in the duplicate collection of the Geological Survey of India), was examined. This is a beautiful rock in the hand specimen, the sodalite being azurite blue (IX, 53, *m*), and shading with admixtures of the accompanying white minerals to pallid violet-blue (IX, 53, *f*) and other lighter shades.

Small fragments of this specimen were very similar to those from the beads and the same suite of minerals was found to be present.

There are the remnants of a yellow incrustation upon bead *j* 1. In this connection it is interesting to note what Dr. Heron has said regarding the weathering of elaeolite in the sodalite-bearing rocks of Kishangarh[2] : " Both in the syenite and the associated pegmatites it (nepheline or elaeolite) weathers with a thin soft yellowish-grey crust resembling the chalky crust on flint, but this decomposition is superficial, and immediately underneath the mineral is found to be quite fresh."

[1] *Mikrochemisches Praktikum*, Munich, 1924, p. 63.

[2] *Rec. Geol. Surv. Ind.*, lvi, ii, 1926, p. 189.

At first sight it seems hard to understand why the lapidaries of Mohenjo-daro, whose appreciation of colours has already been stressed, should utilize two ugly grey beads such as *j* 1 and *j* 39 ; but when one realizes that the beads are made of nepheline-sodalite-rock and when one sees the beauty of such rock when fresh, one can be sure that the beads were once things of beauty with a brilliant display of azurite blue colours. Their present appearance is evidence of the ravages of time, and cannot be considered as a reflection upon the art of Mohenjo-daro.

CHAPTER XXVII

GAMES AND TOYS

THE children and adults of Mohenjo-daro were just as fond of toys and games as they are in Sind at the present day, and numbers of toys and gamesmen have been found, some of them quite ingenious in design.

Pottery. The majority of the toys were made of baked clay, a substance which can be easily modelled and baked even by the smallest child. There is no doubt, I think, that wood also was used for toy-making, but this material readily decays in soil as salt as that of Mohenjo-daro. It is probably for this reason that no traces have been found of wooden playthings.

Cult objects. It is a moot point whether many of the animals and human figures in baked clay were not cult objects rather than toys. The figurines vary very considerably in quality. Some are exceedingly well modelled, whereas others are of the roughest workmanship. For this reason and because it is often difficult to distinguish between actual toys and cult objects, the majority of the pottery figures, both human and animal, have been described in a separate chapter.

Human Figures as Toys (Pl. CLIII, 25 and 38)

Movable figure. It is not certain whether the figure No. 38 (VS 38) should be classed as a toy, but the once movable arms certainly suggest it. On the other hand, the figure is obviously represented as pregnant and the extreme exaggeration of the buttocks suggests steatopygy.[1] It is hardly likely, therefore, that the figure was the work of a child. The height of the figure is 3·8 inches, and a hole in the soles of the feet suggests that it was carried on a thin stick. This model is of well-burnt clay of a light-red colour and uncoated with a slip. Level, 4 feet below surface.

Nursing mother. No. 25 (HR 6213), the figure of a woman lying in bed nursing a small child, is obviously a toy. The woman wears a kilt which is rather longer than those worn by the cult figures, and also a very curious cap whose top hangs down the side of the head. The bed has uprights at the head and foot, and is obviously too short for its occupant. This toy, which, including the bed, is 4·1 inches long, is somewhat roughly made but does not appear to be the work of a child, though it may have been made for one. First Street, HR Area, at a depth of 4 feet below the surface.

[1] A similar exaggeration of the buttocks is to be seen in many figures of other countries, as, for instance, in clay figures from the Black Earth Lands (Peake and Fleure, *Priests and Kings*, p. 164, fig. 101), and from the Alt valley (*ibid.*, p. 160, fig. 99). See also the limestone figure, represented as pregnant and with very pronounced buttocks, from Iflatum Bunar on the borders of Lycia and Pamphylia (Evans, *Palace of Minos*, vol. i, p. 48, fig. 6), and certain figures of the First Thessalian Period (*Cambridge Ancient History*, vol. i (plates), p. 113, (*c*)).

Votive object. The possibility must not be overlooked, however, that this figure of a mother nursing a child may have been a funerary object, or it may even have been intended as a votive offering to a temple or shrine in order to ensure fertility to the giver.

Foreign comparisons. Funerary objects of this kind made in pottery are well known in Egypt in the seventeenth and eighteenth dynasties. In each case a woman lying on a bed was intended to serve as wife to the deceased in the next world.[1] I do not know, however, of a case from Egypt where the woman is nursing a child. The model beds of pottery that are so often found in Mesopotamian sites, chiefly in the neo-Babylonian period, may also have served as votive offerings.

Toy Animals (Pl. CLIII, 24 and 39)

Movable head. The toy animal from the DK Area seen in Pl. CLIII, 39, is of exceptional interest. It represents a humped bull or cow and has a movable head, including which the figure is 4·5 inches long. In the illustration it will be seen that a string has been passed through the hump of the animal and its hind quarters. This, of course, is modern, and is not altogether satisfactory, because by its means the head can only be pulled back, not pushed forward. Originally a firmer material, such as a bristle or stiff hair, was probably used. The head of the animal in the illustration was not found with the body and can hardly be assumed to have actually belonged to it : but for all that the reconstruction is obviously a likely one. The body of this animal (DK 1719) was found east of Room 6, Block 10, Section C, DK Area, at a level of 4 feet below surface. The head (DK 2183) comes from outside Room 3, Block 16, Section C, DK Area, 3 feet below surface. That this kind of toy was very popular is proved by the number of loose heads that have been unearthed, all of bulls or cows.

Bird-chariot. The pottery animal HR 2186 (Pl. CLIII, 24) is of a composite nature. It has the head and horns of a ram, and the body and tail of a bird. It measures 4·5 inches in length, is hollow, and made of a light-red ware liberally coated with a deep red wash. There are two opposite holes in the animal's sides, through which a stick was probably once passed, either to swing the animal upon, or, as seems more likely, to accommodate a pair of wheels.[2] A smaller hole through the neck was probably intended to take a cord by which this bird-chariot could be pulled along. The figure, which is entirely hand-made, is too good to have been the work of a child, though in all probability it was made for one. Level, 9 ft. 6 in. below surface. Court 124, House X, Section B, HR Area.

Monkey. Of a figure that is not illustrated (E 351) the head and legs are missing, but a tail shows that it was intended to represent a monkey. A hole through the shoulders evidently accommodated a peg to hold the arms very much as in No. 38 in Pl. CLIII. A small hole at the back of the figure suggests that it was fixed upon a stick. This figure is of light-red pottery and somewhat roughly made, though certainly not the work of a child. Its present height is 3·35 inches. Level, 6 ft. 6 in. below the surface.

Clay Baking Pans (Pl. CLIII, 1 and 2)

Saddle-querns. The two clay dishes Nos. 1 and 2 in Pl. CLIII were evidently made by children. The first (HR 4326) is 2·7 inches long and appears to represent a pan with a saddle-quern in its middle, on which rests a muller. Something has evidently been broken off the end of the pan—possibly the figure of a woman engaged in grinding corn.[3] House XVIII, Block 4, Section B, HR Area. Level, 3 feet below the surface.

[1] For an excellent illustration of such a figure, see *Ancient Egypt*, 1917, pt. ii, p. 77.

[2] See two articles on very similar bird-chariots by C. B. Seligman in *JRAI.* 1920, pp. 153–8, and 1928, pp. 247–54.

[3] Since writing the above a complete figure has been found at Harappa. See *ASR.* (1926–7), pl. xxiii, fig. *c*.

No. 2 is somewhat similar, with a quern in the middle upon which rests a muller. In this also something is missing at one end. It is 2·8 inches long and was formerly coated with a red wash.

Possible use. Despite the very rough workmanship of these pottery objects, it is possible that they were intended to be placed in graves, just as similar figures of women kneading bread were placed in some of the earlier tombs of Egypt. As, however, they were found in a house and not in a grave, they have been included amongst the toys.

Whistles (Pl. CLIII, 17 and 18)

Bird forms. Toys of this kind are common at Mohenjo-daro and are invariably in the form of a bird, hollow within and with a small hole in the back near the tail, which when blown into produces a shrill whistle. It is not easy to recognize the species of bird, but it is likely that a dove is intended. The pedestal-like bases with which the birds are provided permit of their standing easily on a flat surface, and make them convenient to hold. It is possible that various modulations could be produced from such whistles and especially the call of a dove.

No. 17 (VS 2162) is made of straw-coloured pottery and stands 2·25 inches high. Level, 4 feet below surface. VS Area.

No. 18 (HR 737) is of light-red clay and is 3 inches high. It resembles No. 17 in everything but colour. Level, 4 feet below surface. Room 2, House II, Section A, HR Area.

Rattles (Pl. CLIII, 11)

Round pottery rattles with small pellets of clay inside are well known at Mohenjo-daro. The one illustrated (C 2567) is among the best of those found. It is 2·55 inches in diameter and is of light-red ware decorated with parallel circles in red paint. Level, 12 feet below surface. Room 9, Block 8, Section C, DK Area.

Decoration. The rattles found vary in size from 1·5 inches to 2·6 inches in diameter, and are all made of light-red ware. Some are plain and others decorated with thick lines, always of red and arranged either laterally or vertically.

Mode of manufacture. These rattles were probably made by wrapping the clay round a combustible core, in the centre of which the roughly made baked clay pellets were placed to produce the sound.[1] In every case they are hand-made, not moulded, and they are invariably well finished, but without a slip. They are found at all levels. In none of the rattles was there a vent-hole to allow the gases resulting from the combustion of the core to escape. Possibly the porous nature of the pottery would of itself permit a gas to pass through easily, and that may be the reason why these toys were not coated with a slip.

Dice (Pl. CLIII, 7–10)

Pottery. That dicing was a common game at Mohenjo-daro is proved by the number of pieces that have been found. In all cases they are made of pottery and are usually cubical, ranging in size from 1·2 by 1·2 by 1·2 inches, to 1·5 by 1·5 by 1·5 inches. One die, however, is rectangular, measuring 1·6 by 1·4 by 1·1 inches. I have found by experiment that owing to the inequality of its sides, all of which are numbered, this particular die has a distinct bias towards the higher numbers.

Marking. The dice of Mohenjo-daro are not marked in the same way as to-day, i.e., so that the sum

[1] In one rattle that we opened were three small clay pellets.

of the points on any two opposite sides amounts to seven. Instead of that, 1 is opposite 2, 3 opposite 4, and 5 opposite 6.[1]

All the examples found are exceedingly well made with well-defined edges; the points are shallow holes averaging 0·1 inch in diameter. The clay of which they are made is light-red in colour, well baked, and sometimes coated with a red wash.

These dice must have been thrown on a soft surface, such as a piece of cloth, or on dusty ground, for their edges show little evidence of wear.

It is not yet known whether these objects were used in pairs, but two specimens found in the DK Area, not far from each other, are exactly the same size. Dice have been found at levels ranging from 1 foot to 15 feet below the surface of the ground, and must, therefore, have been used in the Late and Intermediate Periods at least, if not in the Early Period as well.

Board-games.

It is quite possible that dice were used in conjunction with board-games. Mr. Woolley found dice associated with a draught-board at Ur, but I do not yet know if these dice were similar to those of Mohenjo-daro.

Vedic dice.

Along with horse-racing, dicing was also one of the amusements of Vedic India,[2] and it is interesting, therefore, to find it practised in pre-Āryan times in India. The dice used in Vedic times seem, however, to have been entirely different in shape from those discovered at Mohenjo-daro.

No. 8 in Pl. CLIII (DK 1200) is 1·2 by 1·2 by 1·2 inches in size. The points are 0·1 inch in diameter. The material is baked clay of a light-red colour. Level, 5 feet below surface. Room 4, Block 16, Section C, DK Area.

No. 10 (DK 2362) measures 1·25 by 1·25 by 1·25 inches. The points are 0·1 inch in diameter. Light-red clay that has been well-baked. Level, 1 foot below surface. Room 4, Block 16, Section C, DK Area.

Balls and Marbles (Pl. CLIII, 3–6 and 12–15)

Ornamented ball.

No. 6 (VS 804) is a most curious object. It is globular in shape, though not quite round, and measures 1·75 inches in diameter. It is hand-made and its surface is irregularly covered with small round pellets of clay, each having a small hole pricked in its centre. Some of the pellets have fallen off, disclosing the fact that they were once keyed into place by depressions in the ball itself. Possibly the pricking of each pellet was intended to give them a still firmer hold. As far as can be ascertained without breaking it, this ball is solid throughout, and such an object could only have been used as a plaything. Level, 3 feet below surface. Room 24, House XIX, Block 3, VS Area.

Shell balls.

The three other decorated balls (Pl. CLIII, 3–5) are unusually interesting. That they were used as toys seems likely from the fact that none of them is bored for use as a bead or attachment to a pin. All three are made of shell and each is ornamented with the same design of concentric rings, so cut as to appear in relief. They are all carefully made and finished, and all polished by much wear.[3]

[1] Cubical dice were found at Brāhmanābād in 1854 by Mr. Bellasis, who remarked that they were numbered exactly like the dice of the present day. *Arch. Surv. Ind. Ann. Rep.*, 1908–09, p. 85. Mr. Cousens, however, doubts whether the antiquities unearthed by Mr. Bellasis, and now in the British Museum, were found at a low level.

[2] Macdonell and Keith, *Vedic Index*, p. 2.

[3] The mode of decoration of these shell balls recalls the ornamentation on a round schist casket of the Buddhist period from Ghaz Dheri, Chārsada; on the latter, however, there is a flower in the middle of each ornament. *Ann. Rep. Surv. Ind.*, 1902–03, p. 175, fig. 21.

Details. No. 3 (HR 4087) is 1·1 inches in diameter. Level, 3 feet below surface. Room 1, House XIV, Block 3, HR Area.

No. 4 (HR 4478) is 1 inch in diameter. Level, 1 ft. 6 in. below surface. House XXIII, Section B, HR Area.

No. 5 (DK 3201) is 1·2 inches in diameter. Level, 4 feet below surface. Street between Blocks 1 and 2, Section B, DK Area.

Three exactly similar balls were found in the HR and VS Areas, one (HR 648) being 1·15 inches in diameter, the second (HR 2701) 1·21 inches in diameter, and the third (VS 695) 1 inch in diameter. The first was found west of House II, Block 2, Section A, HR Area, at a depth of 4 feet below the surface.

Another ball (VS 2172) measuring 0·85 inch in diameter was found at a level of 2 ft. 6 in. below the surface of the ground in the vicinity of House XI, Block 2, VS Area (Pl. CLIII, 12). It is beautifully made of variegated agate and is highly polished. The accuracy of its shape is remarkable. Another stone ball (Pl. CLIII, 13) of veined agate (DK 3056) is 0·95 inch in diameter and also of excellent workmanship and highly polished. This was found south-east of Block 1, Section B, DK Area, at a level of 18 inches below the surface.

No. 14 in Pl. CLIII (HR 6007) is a ball made of a hard black stone,[1] carefully polished. It was found at a level of 5 ft. 6 in. below the surface in Room 87, House IX, Block 2, Section B, HR Area. No. 15 (VS 2962) is 1·1 inches in diameter and beautifully made of variegated agate. Level, 1 ft. 6 in. below surface. Room 113, House XVII, Block 2, VS Area.

Stone marbles. A number of small balls (HR 337), averaging 0·48 inch in diameter, were made of agate, slate, veined onyx, and some kind of red and white breccia. The ball made of this last material is not perfectly round, and is also only semi-polished. These marbles, as we may perhaps best call them, were all found together at a level of 2 feet below the surface. From Courtyard 13, House II, Block 2, Section A, HR Area.

There is only one way of making stone marbles of this kind, and that is by continually rolling them in a pan in water mixed with an abrasive. Before doing this, however, each has to be roughly dressed into shape, and we have been fortunate enough to find one that was left in the rough (DK 961). As only the more homogeneous stones can be successfully rolled into shape, we can understand the breccia marble mentioned above being out of shape.

Together with the stone marbles were two measuring 0·4 inch in diameter made of white paste and faience respectively. On the latter an equator was painted in manganese. Both these last-mentioned balls were made in a mould.

Connections. Marbles are known from many ancient sites, but they were uncommon in early Sumer, possibly for the reason that knuckle-bones took their place. They have been found in large numbers at Anau, especially in the South Kurgan, made of pottery as well as of stone.[2] In Egypt they were in use from prehistoric times down to the third dynasty; and they resemble the marbles of Mohenjo-daro in being made of various hard stones.[3]

Knuckle-bones

Curiously enough, we have not found a single example of the knuckle-bone, a game that was extremely common in ancient Babylonia and is equally popular in Iraq at the present day.

[1] Possibly hornblende.
[2] Pumpelly, *Explorations in Turkestan* (1904), vol. i, p. 172.
[3] Petrie, *Prehistoric Egypt*, p. 32, pl. xlvi, 26–31

Wheels (Pl. CLIII, 34–7)

A considerable number of pottery wheels have been found in various parts of Mohenjo-daro. At first sight they might be mistaken for spindle-whorls, but that they are the wheels of carts and other toys seems beyond a doubt.

Of the four wheels illustrated in Pl. CLIII, 34–7, No. 34 (DK 319) is 2·5 inches in diameter and 0·7 inch thick, including the boss. The reverse, which has no boss, is slightly concave. Chamber north of No. 6, Block 8, Section C, DK Area, 3 feet below surface.

Sumerian comparisons.

Some pottery chariot wheels found at Kish are very like those found at Mohenjo-daro, the only difference being that the Sumerian wheels have a raised hub on both sides of the wheel instead of a hub on one side only, as was the rule in ancient Sind.[1] We know for certain that the wheels of the Sumerian vehicles were built up from more than one piece of wood, and very much the same form of construction must be imagined for the wheels of the vehicles used by the Indus Valley civilization, especially as the wheels of the modern Sindi cart closely resemble those of Sumer, and like them were fixed to an axle that revolved with them.[2]

Toy Vehicles (Pl. CXXXI, 38 ; Pl. CLIV, 7, 10, and 11)

Cart-frames.

An object commonly found at Mohenjo-daro and Harappā is a pottery frame of the shape illustrated in Pl. CXXXI, 38 (VS 1018), a portion of which is missing. A restored example is seen in Pl. CLIV, 7. These frames were at first very puzzling, chiefly because they were always found broken with either one end or the other missing. In addition to the holes that are seen in the illustrations of these objects, there are always two others, which pierce two of the three middle bars horizontally. These holes are quite large and served to take a pole. In the illustration (Pl. CLIV, 7) a piece of string is threaded through them. The restoration of one of these frames shows it to be a part of a vehicle that was very similar to those used in Sind at the present day (see Pl. CLIV, 11). Judging from the number of these frames that have been found, we must conclude that toy carts were very popular with the children of Mohenjo-daro.

The restored frame that is illustrated in Pl. CLIV, 7, now measures 7·5 inches long by 3·4 inches wide by 0·62 inch thick. The old portion was entirely made by hand (not in a mould), and could easily have been the work of a child. The ware is light-yellow in colour and moderately baked. There is no doubt about this restoration, as a perfect example was found in the season 1928–9. All the broken frames that have been found would, if similarly restored, be about the same size as the one illustrated.

Net.

The open frame of this ancient cart was probably covered with either a hide or a rope-net. The latter is frequently used for this purpose in modern Indian carts, though the present Sindi vehicles are all provided with a solid wooden frame.

The few models or pictured representations that are known to us of wheeled vehicles of very early date are as follows :—

Ur chariot.

1. The chariot pictured on the limestone slab from Ur, which is dated by Mr. Woolley to about 3200 B.C.[3]

[1] Exactly the same kind of wheel is known at Anau. Pumpelly, *Explorations in Turkestan* (1904), vol. i, pl. 47, fig. 9.

[2] See the writer's remarks on the Sindi cart and a chariot from Ur in the *Antiquaries Journal*, Jan., 1929.

[3] *Ibid.*

2. The pottery model of a four-wheeled wagon found by Pumpelly in the South Kurgan at Anau,[1] which I feel inclined to assign to about the same age.

3. Exactly similar wagons, as well as chariots of the same form as on the Ur slab, in a pre-Sargonic level at Kish.[2]

4. The so-called model tented-wagon found at Ulski, north of the Caucasus, in a kurgan burial of Chalcolithic date. I am inclined, however, to think that this is not a wagon at all; moreover, its date is still uncertain.[3]

Syrian and Egyptian chariots.

At a later date, wheeled vehicles appear in Cappadocia and Egypt. Evidence of their first appearance in the former country is afforded by a seal in the British Museum, published by Mr. Sidney Smith and approximately dated by him to between 2100 and 1900 B.C. On this cylinder seal a four-wheeled chariot, or wagon, drawn by four horses, is represented.[4] In Egypt the chariot appears in Hyksos times (C 1800 (?)–1580 B.C.), but it does not seem to have been in popular use, even in later days, and was only employed in warfare.

The earliest European example of the wheeled wagon is a painted toy vehicle of pottery, provided with four wheels, that was found at Palaikastro in Greece and dated by Sir Arthur Evans as "somewhat anterior to the close of the third millennium B.C."[5]

Central Asian origin.

As far, therefore, as the archæological evidence takes us at present, the wheeled vehicle originated in Central Asia, and seems to have passed thence to the west about a millennium later.[6] Which people were responsible for the invention, we do not know, but they may well have been the inhabitants of Mesopotamia. We may surmise that it did not come from India, because the ancient vehicles found there are of a more primitive pattern than those found at either Kish or at Ur. But it is too early as yet to dogmatize on this subject, for the lower levels of Mohenjo-daro may prove the contrary.

Sledge.

We know from one of the signs on the stone pictographic tablet from Kish[7] that the sledge was in use in Sumer at a very early period, as, indeed, it was in Egypt. Such a vehicle must sometimes have been employed in moving very heavy objects. As time went on, plain wooden rollers would sometimes have been found necessary to reduce friction, and a combination of sledge and rollers must then inevitably have led to the invention of the wheel. Indeed, such a combination of sledge and rollers is actually depicted in a scene in the tomb of Sebeknekht of the thirteenth dynasty at El Kab in Egypt.[8] The wheel of the cart used in Sind to-day, as I have already pointed out, resembles that of the ancient Sumerian vehicle; it is, in fact, a superior type of roller, for the axle is so fixed that it revolves with the wheels.

Carts from Harappā.

Two models of carts found at Harappā show no warlike features. One is made of pottery and the other of bronze.[9] The latter is provided with a canopy for protection from the sun.

[1] *Explorations in Turkestan* (1904), vol. i, pl. xlvii, fig. 11, and p. 172. See also the four-wheeled wagons pictured on a mosaic standard from Ur and dated by Woolley to about 3500 B.C. See Woolley, *The Sumerians*, p. 51.

[2] Mackay, *A Sumerian Palace, etc.*, pt. ii, pl. xlvi.

[3] Childe, *Dawn of Civilization*, p. 142, fig. 64.

[4] Smith, *Early History of Assyria*, pl. vii, fig. *b*.

[5] Cf. *BSA., Suppl. Paper*, i (1923), fig. 12. For another illustration see Evans, *Palace of Minos*, vol. ii, pt. i, p. 156, fig. 78. A third illustration is given by H. R. Hall, *The Civilization of Greece in the Bronze Age*, p. 85, fig. 94, where a brief history of the chariot is given.

[6] I think it may be regarded as certain that the invention was made in an alluvial or non-hilly country.

[7] Mackay, *A Sumerian Palace, etc.*, pl. xxxvi, figs. 7 and 8; *Antiquaries Journal*, vol. viii, pl. lxvii.

[8] See article by Davies in *Jour. Eg. Arch.*, April, 1926, p. 111. Mr. Davies suggests, however, that the objects under the sledge are wheels and not rollers. If this be so, the wheel must have been in use in Egypt before the arrival of the Hyksos.

[9] *Ann. Rep. Surv. Ind.*, 1926–7, pl. xxiii, *d*.

Casting Bones (?) (Pl. CXXXII, 19, 20, 22–45)

The exact purpose for which these pieces of bone and ivory were used is at present uncertain. At first they were thought to be rectangular forms of dice, like the Roman *tali*, but the fact that the markings are very commonly the same on all three or four sides hardly bears this out. Nor for the same reason could they be pieces of inlay. The only apparent solution is that some of these objects at least were used in a game of chance, such as throwing a number on the ground together and noting which way they lay.[1] As will be seen in Pl. CXXXII, there is a considerable diversity in the shapes of these objects. Some are rectangular or square in section, in some cases tapering slightly towards one end (Nos. 23, 24, 25, 29, 31, 38, and 45), and some are round (No. 44); these last are very rare. Bones of triangular section are very common (Nos. 22, measuring 3·07 inches long; 26, 27, 30, 35, 37—2·06 inches long; and 43). Nos. 28, 33, 36, 39, and 42 are of peculiar shape, especially No. 28 (VS 2545) which is shaped like a leg and measures 2·65 inches long by 0·21 inch thick. Several examples have been found of this last type. That No. 28 is not a piece of inlay is proved by the same pattern being incised on both sides. The thin edges of this piece are marked with V-shaped lines. From House IX, VS Area.

Possible use.

No. 34 (C 2004) is cubical like a die, and measures 0·55 by 0·5 by 0·5 inch. It has the same markings on all six sides. This object may possibly have been a piece used on a board-game, for the similarity of its markings prevents it being used as a die.

Evidence of wear.

These ivory or bone objects vary considerably in size. Those found up to the present range in size from 1·65 to 3·25 inches in length. Most of them show evidence of much wear; their edges are rounded and sides highly polished with use. Constant handling has darkened most of them to a deep brown tint. The circular markings upon most of them were made with a tubular drill, and from the clean way in which they are cut, the straight lines seem to have been made with a saw. Care was evidently taken to make the designs as regular as possible, and there is little difference between the designs on the various sides of any one piece, except in their proportions. Where a piece is very thin, the edges as a rule are undecorated. Sometimes, if there was sufficient space, the square cut ends of these objects were decorated with one or two circles; as a rule, however, the ends are plain.

Ornamentation.

No. 23 (VS 2529) has three circles on each of three sides, one at each end and one in the middle. The fourth side is decorated as shown in the illustration. No. 27 (HR 2514) is rectangular in section and has three of its sides marked as in the illustration; the fourth side bears only five simple circles. No. 29 (E 610) is square in section and has two different designs arranged in pairs on adjacent sides. This feature is rare, for as a rule the opposite sides bear the same design. Lastly, No. 45 (C 2004), which is rectangular in section, has the same pattern on three sides, while the fourth is plain except for three longitudinal lines.

Used as dice.

It is, of course, conceivable that these last four objects were used as dice, either in a game by themselves or in conjunction with a board-game of some kind. Even so, there are only two different patterns on each bone; but further combinations could, of course, be made by throwing two or more bones together.

Occasionally, these bones are found in pairs, though not always of the same shape and size, nor marked in the same way.[2] For instance, No. 27 was found with No. 31 in First

[1] Sticks that were found associated with a gaming-board in the tomb of Tutankhamen are said to have had different values according to the way they fell when thrown. For illustrations of these objects, see *Illust. Lond. News*, 5th Oct., 1929, p. 576.

[2] That these bones were sometimes used in threes is proved by the finding of a set of this number in the DK Area. All are much the same size and bear the same marks.

Street between Sections A and B of the HR Area, at a depth of 9 feet below the surface; and No. 34 was found with No. 45, which is entirely dissimilar in shape. Again, No. 23 and No. 24 were together, though of different size and differently marked.

No. 41 (DK o) has lost one end. It now measures 1·4 inches long and is square in section. One end is pointed and there is reason to think that it was employed as an awl. A similar example of one of these sticks being converted into an awl may be seen in No. 12 on the same plate.

Comparisons. Nothing quite like these objects is known in either Mesopotamia or Elam, but somewhat similar sticks have been found in Egypt, where they belong to the First Dynasty.[1]

Fish-forms. The curious pieces of ivory shaped like a fish (Pl. CXXXII, 19, 20, 32, and 40) I regard as being of very much the same nature as the sticks just described. They could hardly have been intended for use as amulets since they are not perforated in any way.[2] Their very high polish, showing that they had been much handled, precludes their having been once enclosed in a wrapping. Some very similar fish, also carved in ivory, have been found in a royal burial at Nagadeh in Egypt,[3] and may have been placed there as a food offering. There is no evidence, however, that these model fish were used for that purpose in ancient Sind.

No. 19 (C 2164) measures 2·58 inches long and 0·25 inch thick. One side is rounded and the other flat. The eye and scale markings are filled in with a red paint. Level, 8 feet below surface. Room 5, Block 8, Section C, DK Area.

No. 20 (E 628) is 2·58 inches long and 0·24 inch thick. It is rectangular in section with slightly rounded angles. Scale markings are filled in with red paint. Level, 6 feet below surface. Trench E, DK Area.

No. 32 (DK 2736) measures 3·24 inches long. Rectangular in section with slightly rounded edges. The eye was marked with red paint and the scales in black. Level, 6 feet below surface. Room 10, House IV, Block 2, Section B, DK Area.

No. 40 (DK 7) is 1·78 inches long by 0·12 inch thick. White deposits in the incisions on this fish suggest that the eyes and scales were filled in with white paint.

Markings. It should be observed that the markings on these fish are the same on both sides. No. 19 could possibly have been used to mark the moves in a board-game, as its sides are differently shaped. The remaining three fish, being cut from flat pieces of ivory, have identical sides.

All these objects (with the exception of the fish) are common at all levels except the end of the Late Period.

Gamesmen or Amulets (Pl. CLIII, 16, 19, 20, 21–3, 26–33; Pl. CLV, 11–25)

Board-games. That some form of game or games played with pieces was common at Mohenjo-daro is proved by the great number of gamesmen that have been found.[4] The materials of which these pieces are made are comparatively few. In order of popularity they are—faience, pottery, shell, marble, agate, slate, and steatite.

Details. No. 11 in Pl. CLV is made of black marble and comes from Room 88, Block 9, L Area. No. 12 is beautifully made of agate, and was unearthed in the chamber south of No. 1, Block 8,

[1] Petrie, *Objects of Daily Use*, p. 52.

[2] Amulets, however, are by no means always perforated; they are commonly carried on the person wrapped, it may be, in a piece of cloth or even loose in the pocket.—[Ed.]

[3] de Morgan, *La Préhistoire Orientale*, t. ii, p. 203, fig. 255.

[4] See, however, Chap. V, pp. 60–2. It is by no means certain that these objects were gamesmen. The larger ones could certainly not have been such, as they are much too heavy.—[Ed.]

Section C, DK Area. No. 13 is of faience and was found in House XXIII, Block 4, VS Area. No. 14 is faience, and comes from the chamber west of No. 2, House XIII, Block 4, Section B, DK Area. No. 15, of white limestone, was unearthed from Room 114, Block 6, L Area. No. 16 is made of green slate and comes from House X, Block 2, VS Area. No. 17, of shell, was recovered from House XIV, Block 2, VS Area. No. 18 is well made in faience and was taken from Block 2 of the Southern Buildings Section. Nos. 19 and 20 are of faience; the former was found in Chamber 18, House IV, Block 2, Section B, DK Area. No. 21 is pottery and came from Room 59, House LIX, Block 8, HR Area. No. 22 is cut from a piece of agate, and Nos. 23, 24, and 25 are made of pottery. Of the last three, No. 23 was found in House XVI, Block 2, VS Area, and No. 24 came from Chamber 6, Block 2, Section C, DK Area.

Nos. 23, 24, and 26 are especially interesting in that they are decorated. The first two are coloured white and red, evidently with the idea of imitating decorated carnelian. The third is more elaborate still ; it is painted in red and black on a cream ground, the hatched lines in the illustration denoting red. Its base is slightly concave. No. 21, also of pottery, is painted dark brown to imitate some kind of stone.

Finish. The majority of these pieces are exceedingly well made and finished. In many cases those made of faience still retain their original colour to a certain extent, in some cases green and in others blue. All the pottery and faience pieces were made in a mould.

No. 16 in Pl. CLIII is well made of light-red pottery coated with a red wash, and its smooth flat base shows signs of wear. It is 1·9 inches high and 1·6 inches in diameter at the base.

No. 19 (SD 893) is also well made. Its base has been rubbed flat on a hard substance. It is 2 inches high and 1·05 inches in diameter at the base. Found in Block 2 of the Southern Buildings Section at a level of 5 feet below the surface.

Shell-cones. The cone-like shell objects illustrated in Pl. CLIII, 21–3 (HR 5539), may possibly also be gamesmen. The three were found together, and average 1·9 inches in height and 1 inch in diameter. Level, 3 feet below surface. Court 36, House LXII, Block 8, HR Area.

No. 26 (VS 1192) is also illustrated in Pl. CLV, 16. It is carefully made of green slate. Level, 3 ft. 9 in. below surface. House X, Block 2, VS Area.

No. 27 (VS 2622) is made of steatite and stands 1·05 inches high. It has a hole in its base, 0·65 inch deep and 0·1 inch in diameter. The decorative grooving is so regular that one suspects this piece to have been turned on a wheel. Level, 7 ft. 8 in. below surface. House XXII, Block 4, VS Area.

Inlay. No. 28 (HR 4480) is made of faience, now light green in colour. It is 1·2 inches high, with a flat base 0·7 inch in diameter. It is well made, but the grooves are slightly irregular and were once filled in with a plastic inlay. Level, 2 ft. 6 in. below surface. Room 30, House LXI, Block 8, HR Area.

No. 29 (VS 3) is also illustrated in Pl. CLV, 22. It is of agate and somewhat roughly made. Level, 2 ft. 6 in. below surface.

No. 30 (DK 1554) is of shell. There is a hole in the centre of the flat base, 0·65 inch deep and 0·2 inch in diameter. This piece is 1 inch high. Level, 8 feet below surface. Chamber 9, Block 2, Section C, DK Area.

Trefoil design. No. 31 (HR 4395) is of paste and shows traces of yellow on its surface. It is 1·1 inches high and 0·65 inch in diameter at the base, in which there is a round hole, 0·7 inch deep and 0·25 inch in diameter. This piece, which is moulded, is covered with an irregular trefoil design. In one place, as shown in the illustration, a cross with a linear filling is incised upon it. Level, 4 feet below surface. Passage 20, House XVIII, Block 4, HR Area.

Nos. 32 and 33 are also illustrated in Pl. CLV, 23 and 25, and have already been described.

Tetrahedral forms. The two regular tetrahedra illustrated in Pl. CLIII, Nos. 40 and 41, are very similar to objects from both Kish and Ur, except that the Mesopotamian specimens that I have seen, though of the same form, have rounded corners, frequently decorated with a small spot of inlay. At Kish and Ur [1] these curiously-shaped gaming men are of extremely early date and belong to the pre-Sargonic period. Though the examples from Mohenjo-daro are not decorated in any way, they can, from their shape, be fairly compared with the specimens from Sumer. If they were not used as gamesmen, it would be difficult to find another satisfactory purpose for them.[2]

Descriptions. No. 40 in Pl. CLIII (SD 2880) measures 0·94 inch along each side. It is coated with a now green-coloured glaze. The blackening of the latter in some places is due to overfiring. Level, 3 feet below surface.

No. 41 (C 46) is made of white limestone. It measures 0·75 inch each way and its corners are slightly rounded. Level, 1 ft. 6 in. below surface. Chamber 6, Block 11, Section C, DK Area.

Evidence of wear. Both these objects show evidence of considerable wear, especially at their edges, suggesting that they were used on a hard surface. No particular polish is observable ; the first example, being glazed, has a naturally smooth surface.

Pottery gamesmen. The poorer people used gamesmen made of pieces of potsherd roughly rubbed into a suitable shape. The board on which these pieces were used was probably roughly marked on the ground, either in the form of squares or small holes scooped out in the dust. With such a board and pieces a game could be played almost anywhere, as the materials for it were always to hand.

We have not yet been fortunate enough to learn for what game these pieces were made. As, however, not more than three gamesmen of identical form and material have as yet been found together, there is reason to think that comparatively few were used, unless, like chessmen, the pieces differed slightly to show their rank. Of this, however, we have no evidence. The boards upon which the pieces were moved were probably of wood and have, therefore, perished.[3] The playing boards that have been found in Egypt and Mesopotamia all have a small number of squares, on which only a few pieces could have been used. The two very early boards, one of dumb-bell shape and the other square, that have lately been found by Mr. Woolley at Ur, have twenty and twelve squares respectively.[4]

Dating. Gamesmen of this kind are found at all levels, except those of tetrahedral shape which are of very early date. The evidence at present is insufficient for us to say that certain shapes were confined to certain periods.

Absence of Model Boats

Up to the time of writing we have not found any models of boats at Mohenjo-daro or Harappā. Pottery boat-models are fairly common in Mesopotamia from the earliest times, and also in Egypt. In all probability, the Indus anciently, as now, allowed of a certain amount of navigation, though, as on all rivers of its type, navigation must always have been very difficult, owing to shifting sand-banks and the changing of the river's course. Albeit,

[1] *Antiquaries Journal*, vol. viii, p. 20.

[2] They may, perhaps, also be compared with the four-sided pyramidal gamesmen found at Jemdet Nasr.

[3] Bricks have since been found marked with squares and holes, which were almost certainly used for a game.

[4] *Antiquaries Journal*, vol. viii, pl. vii ; *Museum Journal*, University of Pennsylvania, vol. xix, No. 1, pp. 20 and 21.

however, that we have found no model boats nor any indication that boats were used, there is every reason to think that the people of Mohenjo-daro must have been well acquainted with shipping and that they made use of the river for purposes of trade.

Model Chairs (Pl. CLIV, 1 and 4)

Despite the fact that wooden articles have almost invariably perished, we know the shape of the wooden chairs in use during the Indus Valley period from the fortunate discovery of the two model chairs in pottery illustrated in Pl. CLIV, 1 and 4.

Details.

No. 1 (VS 1731). The seat of this model measures 2·25 inches long by 1·5 inches wide, and the whole chair stands 2·75 inches high. The back of the seat is supported by a strut. The one leg of the seat is notched—possibly a rough attempt to represent carving or moulding. This model, of which part of the base is missing, is rather roughly made of light-red ware and has no slip. Level, 4 feet below surface. Court of House XXVII, Block 6, VS Area.

No. 4 (HR 6029) has a slightly curved seat measuring 2·5 inches long by 1·3 inches wide. It stands 1·85 inches high. As in No. 1, the back of the seat has a strut. This model is also perfect except for one end of its base, and it is made of a light-red ware coated with a grey slip. It was found in Room 87, House IX, Block 2, HR Area, and is assignable to the Intermediate Period.

Work of children.

There is no doubt that these two objects are toys ; from the roughness of their make, they appear to have been the handiwork of children. These chairs perhaps explain the seated position of some of the pottery figures (Pl. XCV, 19) ; and we may reasonably conclude that the children of Mohenjo-daro were as fond of doll's parties as is the child of to-day.

The heavy clumsy appearance of these chairs strongly suggests that they were cut from one piece of wood, like many of the African stools of the present time. They may have been used mainly for ceremonial purposes.

NOTE ON BIRD-CHARIOTS IN INDIA, EUROPE, AND CHINA

(*By N. G. Majumdar, M.A.*)

In the *Journal of the Royal Anthropological Institute*, 1920, pp. 153–8, Professor C. G. Seligmann drew attention to the "bird-chariots" that occur in Chinese art during the Han period (206 B.C.–A.D. 220), and stated that they "are not Chinese in origin, but were derived from the bird-chariots of the later Bronze Age of Europe". Precisely the same connection was suggested also by B. Laufer in an article published in the *Boas Anniversary Volume* (New York, 1906). Professor Seligmann has since published another article on the subject in the aforesaid *Journal* for 1928, pp. 247–54, in which he points out that the bird-chariot occurs in China also in the third–fourth century A.D., and in modern times in Japan and Siberia. By Chinese artists the bird-chariot is treated as a decorative element, as in the case of a vase in the Victoria and Albert Museum representing a mythological bird supported at the side by two wheels. Often there is an additional bird, but of a smaller size, that takes its place on the back of the bird to which the wheels are attached. In the European examples the bird is mounted on the wheels, and as in some of the Chinese examples, a smaller bird is seen perched upon it. But the bird-chariots of Europe are dated between 1300 and 900 B.C., whereas the Chinese ones are not older than 200 B.C. Therefore, it does not seem plausible that the latter should have originated from the former, and we are thus compelled to look for another source.

In India terra-cotta bird-chariots have been discovered at the prehistoric sites of Mohenjo-daro and Harappā which belong to a date much earlier than 1300 B.C., and they seem to be the earliest of their kind yet known. In these specimens[1] the bird is pierced at the sides by a hole to take a pair of wheels and there is another hole below the neck evidently to pass a string by means of which the bird could be drawn. It will be seen that the idea of the chariot in the case of the Indian as well as Chinese specimens is the same. But the gulf of time between them is too great to enable us to imagine that the prototype of the Chinese bird-chariots are those dug out in the Indus Valley. The type of the bird-chariot as found in the Indus Valley examples appears, however, to have survived down to the historic period in India. Thus, terra-cotta birds pierced with holes for wheels have been discovered at sites which are posterior to the Christian era, as, for instance, at Basārh in the Muzaffarpur District of Bihār (*Archæological Survey Report*, 1903–04, p. 98, and Pl. XXXIX, fig. 7).[2] The object illustrated in the aforesaid Report is similar to those from Mohenjo-daro and Harappā and belongs probably to the Gupta times. In view of the close communication between India and China that was established during the Han Period, the most likely theory seems to be that the bird-chariot as a toy was introduced into China from India rather than from Europe of the Bronze Age. As to whether Bronze Age Europe was dependent on the East, especially India, for the conception of its bird-chariots, is a question that cannot be decided in the present state of our knowledge.

[1] Cf., for example, Pl. CLIII, 24.

[2] Dr. Th. Bloch was of opinion that the holes at the sides were intended to fix the wings. Since then a number of terra-cotta rams pierced with similar holes were found at the same site and Dr. D. B. Spooner suggested that the holes were meant for fixing wheels.—*Archæological Survey Report*, 1913–14, p. 170, No. 432.

CHAPTER XXVIII

IVORY, SHELL, FAIENCE, AND OTHER OBJECTS OF TECHNICAL INTEREST

IVORY

Ivory comparatively rare.

CONSIDERING that the elephant is so commonly portrayed on the seals, strangely few ivory objects have been found at Mohenjo-daro.[1] That the salty nature of the soil is not responsible for this scarcity of ivory is proved by the fact that, if it is not allowed to become alternately wet and dry and is well packed with earth, this material will survive when seemingly harder materials perish.

Plaque.

The ivory plaque shown in Pl. CXXXII, 10 (L 375) is, however, much decayed owing to its position just below the surface of the ground. It is 1·8 inches long by 1·05 inches wide and 0·4 inch thick, but there must be about one-half missing ; the circular device was probably in the middle with another figure on the other side.

Bow.

On the obverse there is a male figure facing to the left with hands on hips. He is represented, in fact, in exactly the same attitude as are the human figures amongst the pictographs on the seals.[2] The same curious position of the arms is also seen in many of the figures on archaic seals from Susa.[3] This figure wears a close-fitting cap with plumes at the back and a short loin-cloth, and carries what may be either a bow or a quiver of arrows on its back. The nose is prominent and the eye elongated, like the eyes of some of the stone statues (Pls. XCVIII and XCIX).

In front of this figure is a circular device which may once have contained an inscription, but its surface is very worn and the inscrption, if any, has disappeared.

Carving.

In several places, especially at the back, this piece of ivory shows evidence of having been sawn into shape. The carving of the figure and of the circular device before it is exceedingly rough ; no attempt was made properly to round the limbs. It is probable that the tool used was a narrow chisel. The back of the plaque is flat and undecorated, except for some roughly scored lines at unequal distances, which, if this be a piece of inlay, would have served to key it in its place.

Provenance.

This plaque was found in Chamber 104 of the L Area together with three seals (Nos. 304, 341, and 382) and the copper blade-axe illustrated in Pl. CXXXIX, 5. In its vicinity several gold-capped beads were found, exactly similar to the pendants in the string of beads No. 4 immediately below the six-stringed bracelet in Pl. CXLIX, and also a small

[1] The few that are found are mostly casting sticks, handles, etc., such as are illustrated in Pl. CXXXII, 15, 17, 22–45.

[2] See Nos. 18, 38, 101, 111, etc., in this work.

[3] *Mém. Dél. en Perse*, t. viii, p. 11 ; t. xvi, pl. xxiii.

pottery jar of the same shape as Nos. 6 and 7 in Pl. LXXXI. Only the northern and eastern walls of Chamber 104 remain, and they belong to the Late Period; this plaque and the objects associated with it must, therefore, be dated to that period.

Ivory sticks. Other ivory objects are illustrated in Pl. CXXXII, 7–8, 11–13, 15, 17, and 19–45, some of which are described in Chapter XXVII on Toys and Games. Their exact purpose is unknown. As most of them are ornamented on every side, they cannot be pieces of inlay; and the fact that the greater number of the longer pieces bear the same device on each side proves that they could not have been used as dice. They may, however, have been used in some other form of game or as a means of divination.

Combs. Among these ivory objects found at Mohenjo-daro should be noticed the two combs illustrated in Pl. CXXXII, 13 and 21, and the two ivory handles in Nos. 15 and 17 of the same plate, of which the latter is exceptionally well carved and finished.

Cylinders. The five ivory cylinders shown in Pl. CXIV, 529–33, are the only ones that have been found. As they are all inscribed, there is a possibility that they were used as seals. No other use can at present be ascribed to them. They cannot be broken hair-pins inscribed with their owner's names, as they never had any points.[1] Experiment has proved that they would serve well enough as seals.

Hair-pins, awls, etc., of ivory are also very rare. The few that have been found are illustrated in Pl. CXXXII, 3, 7–9, 11, and 12, and they are fully described in Chapter XXIV on Household Objects, Tools, and Implements.

SHELL

Superiority of shell. The people of Mohenjo-daro were fortunate in having in shell a material which is in some ways superior to ivory, although its brittleness makes it more difficult to work. The supply of shell was inexhaustible, whereas ivory was not so easily procured. It is, indeed, possible that the only source of ivory was the discarded tusks of elephants. If this animal was sacred, as seems probable by its frequent occurrence on the seals, sometimes with and sometimes without the cult object before it, it might not have been considered lawful to hunt it for either its meat or ivory. If this, indeed, was the case, it would sufficiently explain the comparative scarcity of ivory objects.

Proficiency. In the manufacture of articles of shell the people of the Indus Valley civilization were extremely proficient. In this respect they resemble the inhabitants of early Babylonia.[2] The extensive use of shell for ornaments and, in particular, its use in the manufacture of cylinder seals has been adduced as a proof of the entry of the Sumerians into Babylonia from the south, but there is every likelihood that the Sumerians, even if they did not already know the art of shell-working, found the craft well established in the country of their adoption.

Shell-working is still extensively practised in India and a full report of the methods employed may be found in one of the *Memoirs of the Asiatic Society of Bengal*.[3]

Species of shell. At the present day, the shell used in the manufacture of bangles is the sacred Indian *Sank*, or conch (*Turbinella pyrum* Linn.), most of which comes from the Gulf of Mannār

[1] We have lately found two undoubted cylinder-seals, both made of steatite and of the shape that is usual in Mesopotamia and elsewhere.

[2] In the manufacture of shell inlay, however, the people of Mohenjo-daro were not so adept as the Sumerians. In India, we do not find the wonderful figures carved in this material that we find in Sumer. Possibly the people of Mohenjo-daro used wood as their chief medium of expression; and this material would have had no chance whatever of survival in the damp soil of this site.

[3] By James Hornell, vol. iii, 1910–14.

between India and Ceylon. It is said that frequently 4,000,000 to 5,000,000 of these shells are imported into Madras and Calcutta in a year.

Most of the shells that have been found at Mohenjo-daro are, however, of another genus (*Fasciolaria trapezium* Linn.), though one specimen of *Turbinella pyrum* has been recorded by Colonel Sewell. A single specimen is also recorded of *Turbinella pyrum*, var. *fusus* Sowerby, as Colonel Sewell explains in Chapter XXXI on the Animal Remains. It is probable, therefore, that the people of the Indus Valley civilization obtained their shells from a number of places along the coast of India and the Persian Gulf.

Mother-of-pearl.

It is noteworthy that the shell of the pearl-oyster was not used for any purpose at Mohenjo-daro, despite the beauty of this material and the fact that it is common in many parts of the Persian Gulf. The Sumerians made frequent use of mother-of-pearl for their inlay ; it seems, indeed, to have been as common with them as the *śank* shell, especially in the pre-Sargonic period.

Modern shell-working.

The method of preparing the *śank* shell in modern India is interesting. According to Mr. Hornell, the columella is extracted by sawing off a slice of the lip and then breaking down with a hammer the septa connecting it with the walls of the shell. The apex of the shell is then smashed and the columella freed. This leaves a hollow tubular piece of shell which can readily be sawn into bracelets.

Use of saw.

The iron saw used in India at the present day is worked by hand and is of deep crescentic form with a horn at each end of the upper edge.[1] The thickness of the blade is 2 mm., except for a distance of 1 inch from the cutting edge, where it is thinned down to a thickness of 0·6 mm. The teeth of the saw are extremely minute, and dentate in form instead of serrate. The upper edge of the saw is reinforced by a piece of iron piping, whose weight doubtless assists in the cutting. The saw requires frequent resharpening owing to the hardness of the shell, but this process does not take very long. Mr. Hornell remarks that shell-slicing calls for the possession of a highly trained eye, perfect steadiness of hand and arm, and an iron-like capacity to sit for long periods in a position of great discomfort. On an average it takes 4½ minutes to saw once through a shell.

After a section has been sawn off the inwardly projecting beak, which is the remnant of the septum between adjacent whorls left after removing the columella, has to be chipped off with the greatest care ; this part of the ring is its weakest point. A sharp-edged hammer is used for the purpose.

Finish.

The rubbing down of the inside of the segments is done with a wooden spindle coated with fine river sand embedded in lac, several segments being smoothed down at the same time by a to and fro movement. All that then remains to be done is to polish the outer surface and to engrave it, if required, the tools used for this purpose being drills, files, and small saws.

Manufactories.

The manufacture of shell articles was evidently carried on in certain parts of the L Area at Mohenjo-daro. We found no less than thirty-five shells in Chamber 44 ; eleven shells in Chamber 53 ; fifteen shells in Court 69 ; twenty-four shells in Space 70 ; and twenty-three shells in Chamber 27, as well as smaller numbers in other parts of the area. Most of these shells were whole, but from some the columella had been removed, and from the condition of the latter it is clear that the columella was detached from the walls of the shell by means of a hammer, just as is done at the present day.

Waste.

At Mohenjo-daro practically the whole of the shell was utilized. The walls were used for bangles, both wide and narrow, and the columella for making beads. For the simpler forms, such as disc-shaped or cylindrical beads, the columella was simply sliced up with a saw ;

[1] The bronze saw pictured in Pl. CXXXVII, 7, of this work may well have been used for cutting shell.

for the more elaborate beads a considerable amount of shaping by other means was required after they had been sawn off. The columella was also used for making pieces of inlay work, which required considerable skill, especially in the fretting of the designs, which is a most difficult task with such a very brittle material.

In Pl. CLVI, 20 and 21, two of these *sank* shells are seen with their columellæ lying beside them (Nos. 22 and 23); and a smoothed columella with several partially finished beads may be seen in Nos. 15 and 24 on the same plate.[1]

Dippers. The shell dippers illustrated in Pl. CLVI, 26–9, must have taken up a large part of the shell for their manufacture, the smaller ones being made from small shells, and the bigger ones from those of larger size.[2]

In Pl. CLVI, 11 (L 781), a shell object of unknown use is illustrated, which measures 1·7 inches high. This object seems to have had another piece of shell fitted to it, for it has a slanting and somewhat roughly finished back, with a vertical channel scooped in it measuring 0·25 inch wide. There is a lightly incised herring-bone pattern around the base of the object, and each of the exposed sides bears an incised pattern, as shown in the illustration. This object may possibly be part of the head-dress of a small statue. It was found in Chamber 4 in the L Area just below the surface of the ground.

Shell Inlay (Pl. CLV, 26–42 and 44–67; Pl. CLVI, 1, 4, and 12)

Curvature. The shell inlay illustrated in Pls. CLV and CLVI, No. 12, gives the reader a very good idea of the capabilities of the shell-cutter at Mohenjo-daro. Most of the circular designs must have been cut from the columella of the shell and were limited in size by its diameter. Others of the designs were cut from the wall of the shell, but these pieces, if large, suffer from the disadvantage that its natural curvature rendered them barely flat enough for inlay work. In the smaller pieces, where thinness does not matter, this difficulty could be overcome by rubbing down one or both surfaces; but in the larger pieces this process involved the risk of fracture.

Fretting. It is not yet known how these pieces of inlay were fretted out, for we have not found an unfinished specimen. There are three possible ways :—by means of a small chisel or burin, by means of a fine saw, or by means of a drill. The third method would certainly have been the simplest. Yet the edges of most of the pieces of inlay show marks that might have been made by either a file or saw. Possibly, when the shape of the piece had been outlined with the drill, a fine saw was used to complete the cutting and then a file to smooth the edge.[3]

Bevelled edges. In most of the simple designs the outer edges of the pieces of inlay, whether of faience or shell, were slightly bevelled for keying. In the more complicated pieces, this bevelling was unnecessary; there was enough surface without it to hold the inlay in place.

Thickness of inlay. The thickness of these pieces of inlay varies considerably. Some of the smaller pieces are as thick as, or even thicker than, the larger pieces, chiefly because it was unnecessary to rub them down to reduce the curvature as in the case of the larger ones. In addition, the cement in which they were set amply allowed for variation in the depth of the pieces of inlay which average from 0·1 inch to 0·15 inch in thickness.

Bitumen cement. Owing to the fact that wood perishes in a salty or damp soil, no pieces of furniture have been found with the inlay still in position. In early Babylonia the method usually adopted in inlay work was to press the pieces into a cement of bitumen, whose dark colour contrasted

[1] The smoothed down columella illustrated in No. 15 has been notched for slicing.

[2] *Murex* (*chicoreus*) *ramosus*, Linn.

[3] Even a fine wire coated with an abrasive could have been used for this purpose.

well with the white of the inlay. Possibly the same technique was sometimes adopted at Mohenjo-daro; we have evidence that bitumen was known there since this substance was used to line the inner wall of the Great Bath.[1] As in early Babylonia, the use of shell inlay was perhaps not confined to the adornment of wooden articles, but was extended to stone and for the inlay of the eyes of statues, as in the one illustrated in Pl. XCVIII.

Plaster cement. In the angles of the piece of inlay figured in Pl. CLV, 48, traces of a white substance were found that suggest that this particular piece, at all events, was laid in plaster. The surface of the latter would probably have been coloured to make a contrast with the cream tint of the inlay itself.[2]

Petals. Nos. 26–8 in Pl. CLV, which average 0·15 inch in thickness, are very common shapes and evidently formed part of a floral design; they probably represent the petals of a flower. The incurved end of No. 27 suggests that it was once laid against a circular piece of inlay, which may have formed the centre of the flower.[3] It is hardly likely that the centres of these petals were left hollow; like the inlay in Pl. CLVI, 12, they were probably filled in with other pieces of shell of exactly the same shape, but smaller in size. No. 30 is most unusual; indeed, it is the only piece of this shape that has yet been found. It, too, probably formed part of a floral design. No. 27 was found in Room 34, House XXVIII, Block 5, Section B, HR Area, and No. 28 in the street between Blocks 1 and 2, Section B, DK Area. No. 30 comes from Room 87, House IX, Block 2, Section B, of the same Area.

Stepped designs. Nos. 31–3 in Pl. CLV, which are all of shell and an average thickness of 0·2 inch, illustrate a design which is very common, especially in the L Area. As they are generally of large size, these pieces were usually cut from the walls of the shell instead of from the columella. Curiously enough, this design does not appear on any of the painted pottery of Mohenjo-daro, though it is frequently found on the modern painted ware of Sind. The motif No. 33 is exceedingly common on the painted pottery found by Mr. Hargreaves at Nāl in central Balūchistān.[4] The shape illustrated in No. 32 has also been found on a piece of pottery from Nāl.[5] It is also incised on a stone vase found at Bismya, but it is an open question whether the design does not in this case represent a ziggurat or temple-tower.[6]

Very much the same design is found on some of the painted pottery from Anau in Turkestan,[7] and what appears to be a variation of the same motif occurs on painted ware of the First Period of Susa.[8] It is unknown, however, on the painted pottery of Jemdet Nasr, nor do I know of its occurrence on any other pottery from Mesopotamia. Both Nos. 32 and 33 came from Chamber 15 of the Great Bath Building, and No. 31 from Chamber 53, Block 2, L Area.

Cross designs. Nos. 34 and 35 in Pl. CLV, which are also of shell and are 0·08 inch thick, are allied to the three pieces of inlay just described. Each is made up of two pieces, one inside the other. They were found amongst a number of other pieces of inlay in House 9 of Section B of the HR Area at a depth of 4 feet below the surface. As the walls of this house belong to the Intermediate Period, this inlay must also be of that date. The form of cross shown in No. 34

[1] Chap. III, p. 25.

[2] We have now positive evidence that plaster was frequently used to hold inlay and that its surface was coloured red. This plaster is generally gypsum.

[3] Compare in shape the pieces of crystal inlay from a Minoan medallion of M.M.I. period. Evans, *Palace of Minos*, vol. i, p. 470, fig. 337.

[4] *Mem. Arch. Surv. Ind.*, No. 35, pl. xvii, fig. 48.

[5] *Ibid.*, pl. xviii, fig. 9.

[6] Banks, *Bismya*, p. 242. Compare also fig. 137, t. xii, and pl. vi, t. xvii, in *Mém. Dél. en Perse*.

[7] Pumpelly, *Explorations in Turkestan* (1904), vol. i, pl. 35.

[8] *Mém. Dél. en Perse*, t. xiii, pl. v, fig. 9; pl. vi, fig. 5; and pl. viii, fig. 6.

and again in Pl. CLVI, 12, also occurs on the bezel of the silver ring seen in Pl. CXLVIII, *a*, 13. With arms of equal length, the motif is known on the pottery from Susa [1] and also on seals from that place.[2] In some cases, both on the pottery and seals, the resemblance is rendered closer by there being one cross inside another, as in No. 34.[3, 4]

Foreign examples of motif. This cross design also occurs on a painted potsherd from Harappā. It has not yet been found on the painted pottery of Mesopotamia, but on Kassite seals it is very common indeed, both with and without the central cross.[5] It does not appear on the pottery of Anau.

Equal armed crosses are, of course, known in many parts of the ancient world, but, as far as I can discover, it is only in early Crete, Babylonia in Kassite times, Elam, and India that representations occur of this double cross.[6] In Crete this cross, as well as a plain one, appears in M.M. III, the former as a piece of faience inlay and the latter in marble.[7]

On the pottery of Susa, another form of cross, the pattée, seems in some cases to be allied with the one under discussion ; the plainer cross tends to approach to the pattée form, as if the jar painter were not quite certain in his mind what particular form of cross he intended to draw. Indeed, one form was probably derived from the other, and the pattée form is probably the older, as it is so common in the earliest period of Susa.

Rosettes. The design of Nos. 36 and 37 (Pl. CLV), which are both of shell, is fairly common at Mohenjo-daro and is found on some of the seals of the adjacent countries. Here we may have an early form of the rosette that was used as a decoration in the early as well as the late periods of Persia, Mesopotamia, including Assyria, and Egypt.[8] Such a simple design may well, however, have been invented independently ; no doubt it was derived from one of the Compositæ. No. 37 was found in the Great Bath at a level of 3 feet below the surface of the ground, and No. 36 in Chamber 13 of the same building.

Heart-shaped designs. Nos. 38–47, which range in thickness from 0·15 to 0·2 inch, are all variations of the same motif. With the exception of No. 43, which is of faience and was found in the Great Bath building, they are all made of shell. No. 38, from Enclosure 50, Block 1, L Area, is of especial interest, as its centre has not been fretted out, though otherwise it appears to be finished. I do not know of its occurrence outside India, in either its simple or more complex form, unless it be the same motif that occurs at Knossos and is said to represent the seed-vessel of the *silphium*, an umbelliferous plant which is supposed to be extinct, but " whose nearest available comparison is said by Evans to be supplied by the *narthex* of north Kashmir ".[9]

Animal markings. Very much the same device is seen on the side of an antelope on a copper tablet (Pl. CXVIII, 3), and also on a rhinoceros (Pl. CXVII, 7). Represented as it is on animals of two separate species it cannot be intended for a natural marking. Perhaps this symbol was painted on the living animal as a decoration, as are the various painted devices that adorn

[1] *Mém. Dél. en Perse*, t. xiii, pl. ii, fig. 1 ; pl. vii, fig. 1 ; pl. xv, fig. 4 ; pl. xxi.

[2] *Mém. Dél. en Perse*, t. xvi, pl. vi, fig. 101, and pl. xxi, fig. 314 ; t. viii, p. 5, fig. 9 ; p. 10, fig. 20.

[3] *Mém. Dél. en Perse*, t. xii, p. 94, fig. 65, and p. 91, fig. 42.

[4] According to Herzfeld this cross motif is found on painted pottery in Iran as late as 2000 B.C. *Illustrated London News*, 1st June, 1929, fig. 11.

[5] Ward, *Cylinder Seals of Western Asia*, pp. 184–92.

[6] But see *Mem. Arch. Surv. Ind.*, No. 37, pl. xvi, DN. d. 28, for an example of this motif from northern Balūchistān.

[7] Evans, *Palace of Minos*, vol. i, p. 515, fig. 375. It is possible that the motif was introduced into the West from Elam by the Kassites.

[8] It is found in the First Dynasty of Egypt and in inlay work from the royal tombs of Ur.

[9] Evans, *Palace of Minos*, vol. i, pp. 284–5. Sir Arthur Evans points out that the motif, as well as occurring in the Knossian signary, is also found on coins of Cyrene, for which also see reference above. The resemblance is especially close to the markings on the two objects pictured as Nos. 10 and 12 in Pl. CLVII of this work.

state elephants in India at the present day. With it may be compared the trappings (?) on the withers of the so-called unicorn on the seals.

No. 44 was unearthed from Room 14, Block 16, Section C, DK Area, and No. 47 from Room 7, Block 2, Section B, DK Area.

Fretted roundels. Nos. 48–51 are all circular motifs with their interiors fretted out in various ways. The same design that is present in Nos. 48 and 49 is also seen on some of the Nāl pottery,[1] but it does not occur on the painted pottery found by Sir Aurel Stein in Northern Balūchistān and, as far as I can ascertain, it is unknown in both Susa and Mesopotamia.[2] In Crete the pattern occurs on a gaming board dated to the M.M. III period.[3] The same motif is seen on the faience nose-ornaments illustrated in Pl. CLII, 7, 8, and 14.[4] There seems a possibility, however, that this design may have been derived from the cross enclosed in a circle that is seen on some of the pottery of the First Period of Susa.[5] If the cross itself be removed from the Susian designs a motif very much like Nos. 48 and 49 is left. No. 50 is especially elaborate and is the only example of this design that has been found. Like the rest of the inlay it is made of shell. No. 51, of shell, was found in Chamber 41, Block 1, of L Area. No. 48 came from Chamber 14, House I, HR Area.

Eye designs. Nos. 52, 54, 55, and 56 are pieces of shell inlay that probably once formed part of a complicated design. No. 53 is perhaps unfinished, though it could have been used in its present state. No. 54 originally fitted inside No. 55, in which position it is shown in Pl. CLVI, 12. No. 58 is a simply cut piece of shell, very similar in form to some pieces of ivory (?) that were found beneath the foundations of a temple at Susa.[6] The same simple motif occurs repeatedly in a painted plaster frieze in a palace at Nimrud.[7] The design, however, is so simple, being either a square or in some cases a rectangle with incurved sides, that its use in several different countries need have no significance. The lozenge-shaped piece of inlay (No. 57) was unearthed from Chamber 51, Block 1, L Area, and No. 55, which was associated with No. 44, came from Room 14, Block 16, Section C, DK Area.

Leaf design. That No. 61 was cut from the walls of a shell is evident from its curvature. It is clearly a leaf that once belonged to a floral design. I found exactly the same shape, but smaller, in a very early level at Kish. This same pattern is also extensively used in Syrian mother-of-pearl inlay at the present day. From the northern end of First Street, HR Area. Level, 10 feet below surface.

Nos. 59 and 62 are simple pieces of shell inlay, but No. 60 is of uncommon shape and very closely resembles some small pottery amulets found at Harappā, which seem to be peculiar to that place as none have been found at Mohenjo-daro. This last piece was recovered from the lane between Blocks 4 and 5 of the Southern Buildings Section, at a level of 3 feet below the surface.

Petal. No. 63, again of shell, found in Block 5, Section C, DK Area, is evidently a part of a floral design, and so is No. 64, which is also illustrated in Pl. CLVI, 1. This last comes from Chamber 45, Block 1, L Area. This segment is 0·2 inch thick and its reverse is plain.

[1] *Mem. Arch. Surv. Ind.*, No. 35, pl. xx, *d*.

[2] Compare the design on a bronze stamp from Anau. Pumpelly, *Explorations in Turkestan*, vol. i, pl. 51, fig. 8.

[3] Evans, *Palace of Minos*, vol. i, pl. v.

[4] And on the pottery figured in Pl. LXXXVII, 2 and 4, and Pl. XC, 22. I suggest that this motif is derived from interlocking circles.—[Ed.]

[5] *Mém. Dél. en Perse*, t. xiii, pl. vii, fig. 1; pl. xvii, fig. 6.; pl. xviii, figs. 3 and 4; pl. xxi, fig. 4.

[6] *Mém. Dél. en Perse*, t. vii, p. 120, fig. 422.

[7] Babelon, *Manual of Oriental Antiquities*, p. 115, fig. 87.

Nos. 65, 66, and 67 are all of shell and may be unfinished specimens, though No. 67 is an especially common shape at Mohenjo-daro. The latter has been included amongst the shell inlay as it seems to belong nowhere else. It could hardly have been used as a finger-ring owing to its thinness, in addition to which there is insufficient room for the finger. No. 65 comes from Room 2, Block 6, Section C, DK Area.

Shell segments.

A variety of inlay work is illustrated in Pl. CLVI, 2–5. These pieces of shell seem to have once decorated handles in a similar manner to the pieces of shell which were strung on stout copper wire alternately with similar shaped pieces of some other material to form certain wand-like objects found in early Sumer and Elam.[1]

No. 2 (VS 2187) is unfinished and unperforated. It is 1·05 inches in diameter and 0·61 inch thick. It is heavily grooved both on the top and base, so that a wavy appearance of the edge is produced. Level, 5 feet below surface. House XXII, VS Area.

No. 3 (VS 2182) is a similar piece, but perforated. It is 0·51 inch thick and the diameter of its hole is 0·39 inch. Level, 4 ft. 6 in. below surface. Structure XVII, VS Area.

No. 4 (HR 210) is only a fragment of a once finished piece. It is 1 inch high and its estimated diameter is 0·6 inch. The thickness of its wall is 0·2 inch. Level, 8 feet below surface.

No. 5 (B 441) is well preserved and measures 0·37 inch high. The diameter of its hole is 0·33 inch. Level, 4 feet below surface. It was found in Room 5, Block 3, Section B, DK Area.

All these objects were cut from the columella of the shell, and the grooves on the top and base were made with a saw before the piece was perforated. Those pieces which were finished were always very carefully made and polished, except on the top and base, where they would have been covered. Articles of very similar shape, made of white paste and coated with a red slip to simulate carnelian, are illustrated in Pl. CLVII, 10 and 12.[2]

Animal figures.

Animal figures in shell or any other kind of inlay were apparently not made at Mohenjo-daro, though they are frequently found in Babylonia, where it might almost be said that animal and human devices were as common as floral or other designs. To cut a figure in shell is a difficult piece of work ; it was for this reason, perhaps, that animal designs were not used in inlay work by the people of the Indus Valley Civilization.

Shell receptacles.

A few shells with their excrescences smoothed off and the columella removed seem to have been used as receptacles for water. Occasionally, the smooth surface of the shell was ornamented with small concentric circles made with a drill, and in one case two of these placed near the apex of the shell were apparently intended to represent eyes (HR 3157, Pl. CLVI, 25).[3] This last object measures 4 inches long and was found in First Street of the HR Area, at a depth of 5 feet below the surface of the ground. In Sumer similarly smoothed shells were used as drinking cups or for libations or ablutions,[4] and sometimes with accretions as lamps.[5]

Unfinished object.

A partially finished piece of cut shell illustrated in Pl. CLVI, 14 is 1·95 inches long. This interesting fragment (HR 1828) was perhaps intended for the eye of a statue, for an eye has been distinctly incised upon it and the piece has been carefully rounded on one side to follow its outline. This fragment of shell is 0·2 inch thick, and it has been partially sawn

[1] *Mém. Dél. en Perse*, t. i, p. 121, fig. 253 ; t. vii, p. 102, figs. 330 and 331.

[2] For these undulating rings see *supra*, pp. 61–3.—[Ed.]

[3] These eyes do not appear in the illustration.

[4] E.g., at Kish. For a good example, also decorated with eyes, see Mackay, *A Sumerian Palace, etc.*, pt. ii, pl. xxxviii, fig. 3.

[5] Woolley, *Antiquaries' Journal*, vol. viii, pl. vii, fig. 2.

through along its edge, forming a groove 0·04 inch wide. Level, 8 feet below surface. House III, Block 2, Section A, HR Area.

Jar-stopper.

There is one example of a jar-stopper (DK 1602) made from a piece of shell. This is illustrated in Pl. CLVI, 6. Though somewhat roughly finished, this object with its long shank must have admirably served its purpose. It is 1·72 inches long and was found 4 feet below the surface, in Chamber 7, House XII, Block 4, Section B, DK Area.

Faience and Paste (Pl. CLV, 43, 68, and 69 ; Pl. CLVII, 13–53)

That the art of glazing flourished at Mohenjo-daro is proved by the number of pieces that have been found. Unfortunately, some of them are so broken that it is difficult to determine what they once were, but some of the better preserved pieces are illustrated in Pl. CLVII, 13–53.

Faience inlay rare.

Only a very few pieces of faience inlay, however, have been discovered. In most cases they are quite unlike the pieces of inlay made of shell, though occasionally the shell patterns were copied, e.g., Pl. CLV, 43, and Pl. CLVII, 34. This piece of inlay measures 0·1 inch thick and has bevelled edges which were intended to key it well into the substance in which it was set. It is made of a soft paste coated with a glaze, which is now light green in colour.

No. 68 in Pl. CLV is a long piece of faience which is flat below and slightly rounded above. The upper curvature of the piece sufficed to key it firmly in its setting.

Petal.

No. 69 in Pl. CLV (see also Pl. CLVII, 31) is 0·25 inch thick. Its upper surface, which is flat, is decorated with incised parallel lines set obliquely. It is made of paste and still shows traces of the original glaze, which is now light green in colour. It was first of all thought that, as this piece is decorated on both sides, it could not be a piece of inlay. As, however, it is unperforated, it could hardly have been used for any other purpose. Being made in a mould, like all the faience objects, it is possible that both sides were decorated so that after glazing the better side could be placed uppermost. The grooving of the underside would then have served to key it in position.[1] Room 12, Block 3, Section B, DK Area.

Box-cover.

In Pl. CLVII, No. 13 (DK 3002), which is 2·15 inches wide, appears to be the cover of a box. Only the decorated top is shown, the underside being similar to that shown in No. 14. The thickness of the cover is 0·15 inch, or, including a slight edging that formerly ran round all four sides, 0·4 inch. The design upon it was a favourite motif. It is found on pieces of shell inlay and on the faience nose-studs seen in Pl. CLII, 7 and 8. Level, 1 ft. 6 in. below surface. Room 9, House IV, Block 2, Section B, DK Area.

No. 14 (DK 1818) is a fragment of a similar cover, which is decorated with a simple design of incised parallel lines set close together and apparently once filled in with a white paste. Level, 3 feet below surface. Room 15, House XII, Block 4, Section B, DK Area.

Canvas.

Both these covers seem to have been backed inside with a canvas-like material, whose impression is shown in No. 14. This backing must have been used to hold together the paste of which they were made preparatory to glazing them. It was burnt away in the kiln. The surface glaze has almost disappeared from both covers, though traces of the original blue or green still remain here and there. In each case the glaze penetrated well into the paste forming a hard, but somewhat brittle material. No. 13 has a minute hole on either side of the unbroken corner, perhaps for a string hinge.

Incised decoration.

No. 15 (DK 2256), which is 1·8 inches long, is a fragment of a cover of a box. Its interior surface shows that the light green, vitreous paste of which it is made was laid on

[1] Compare in shape with fig. 423, p. 120, t. vii, of *Mém. Dél. en Perse.*

a foundation of some woven material, as is the case with Nos. 13 and 14. The edge of the cover is rather deeper than usual, i.e., 0·25 inch. The outside of the edge is decorated with scored parallel lines placed obliquely. Level, 1 ft. 6 in. below surface. Room 17, Block 3, Section B, DK Area.

No. 16 (DK 2691) is a fragment of a small piece of inlay, flat and plain on one side and scored with lines on the other. It is made of a vitreous paste and is light blue in colour. Level, 3 feet below surface. From between Blocks 1 and 2, Section B, DK Area.

Nos. 17 and 18 (DK 2992) illustrate a hollow, cone-shaped object with a small rounded head, measuring 1·27 inches high and 1·2 inches in diameter at the base. Inside there is a flat projection with a small hole in it to enable it, perhaps, to be sewn to a garment. This object, which is now of a light-green tint, closely resembles the conical gold object No. 2 seen in Pl. CXLVIII at the top of Photograph A. Level, 1 ft. 6 in. below surface. Block 1, Section B, DK Area.

Paste inlay.

No. 19 (HR 1546) is 1·15 inches high and 0·1 inch in diameter at its base. A hole runs through it, of equal diameter—0·45 inch—throughout. On the upper part of the object there are three horizontal grooves, each of which is 0·1 inch in diameter and about the same in depth. These grooves were doubtless intended to contain a paste inlay. The use of this object, which is too short to have served as a handle, is uncertain. Its glaze is now apple-green in colour, and was evidently overfired. Level, 7 ft. 6 in. below surface. From space between Houses III and VI, Section A, HR Area.

No. 20 (L 809) is a glazed spacer of unusual shape, which still shows traces of the original glaze, now green in colour. This bead, which is 0·8 inch in diameter and 0·2 inch thick, was found just above the second pavement of Chamber 59, L Area. It is also illustrated in Pl. CXLVII, 10.

No. 21 (DK 2172) is a fragment of what may have been a cover, 2·66 inches in diameter and 0·2 inch thick. It is made of a vitreous paste, now light green in colour. Room 14, Block 2, Section B, DK Area.

Bracelet.

No. 22 (DM 132) is a fragment of a glazed bangle which is fluted on the outside. It is of a greenish-blue colour right through its thickness. The paste of which it is made is vitreous in nature and pitted with air-holes. Level, 4 feet below surface. Stūpa Section, SD Area.

Convoluted pattern.

The surface of No. 23 (HR 3465), which is a piece of white paste, has an indefinite design carved upon it that is somewhat reminiscent of the trefoil pattern on certain of the beads and on the cloak of the steatite figure seen in Pl. XCVIII. A number of these pieces were found, averaging 0·25 inch in thickness, but no joins could be made. Judging from their flatness, they may have once formed part of a box. They were found at a depth of 8 feet in First Street of the HR Area, and are probably of Intermediate date.

Lozenge pattern.

No. 24 (DM 393). Fragment of a piece of inlay. Base plain and upper surface scored with diagonal lines forming a lozenge pattern. Light green, vitreous paste. Level, 1 foot below surface. Stūpa Section, SD Area.

No. 25 (HR 5718). 0·75 inch high. This is a solid piece of paste ornamented with horizontal grooved rings that probably once held a paste inlay. The object has a red coating suggestive of a glaze; it may have been a gamesman.[1] Level, 6 ft. 3 in. below surface. Room 37, House XXI, Block 4, Section B, HR Area.

No. 26 (SD 717) is a portion of a small faience vase made of a green, vitreous paste. This piece was found in one of the cells on the southern side of the Great Bath. Level, 5 feet below surface.

[1] Or perhaps a baetylic amulet. See *supra*, p. 61.—[ED.]

Trellis. No. 27 (HR 769) is a fragment of glaze, now apple-green in colour, that may have been a piece of inlay or the side of a box. It measures 1·9 inches in length by 0·15 inch in thickness. Its very fine moulding gives an idea of the capabilities of the workers in faience at Mohenjo-daro. Level, 5 feet below surface. House I, Block I, A Section, HR Area.

No. 28 (DK 1818) is a portion of a plaque-like object of a green, vitreous paste, full of blow-holes, measuring 2·05 inches long and 0·17 inch thick. The reverse is flat and unornamented, whereas the upper surface is deeply scored with parallel lines. Level, 3 feet below surface. Room 15, Block 4, Section B, DK Area.

No. 29 (HR 2665) is again a portion of a plaque of a very vitreous, light blue paste full of blow-holes. It measures 1·9 inches wide and 0·3 inch thick. Its reverse is flat and plain, and one corner is missing. The upper surface is ornamented with oblique incised lines which form a series of lozenges. Level, 7 feet below surface. House IX, Block 3, Section A, HR Area.

No. 30 (HR 2929) is a fragment of vitreous paste, light green in colour and 0·3 inch thick. It is decorated on both sides with oblique incised lines. Level, 3 feet below surface. House X, Section B, HR Area.

No. 31 (DK 2730), which is of white paste with traces on its surface of a light green glaze, measures 2·25 inches long by 0·25 inch thick. As in the case of No. 30, both surfaces are adorned with oblique lines. (See also Pl. CLV, 69.) Level, 4 feet below surface. Room 12, Block 3, Section B, DK Area.

Bevelled edge. Both these objects are presumably pieces of inlay, especially No. 30, whose edge is bevelled. The advantage of scoring both sides is that, after glazing, the better side could be placed uppermost and the less successful hidden in the cement of the setting.

Nos. 32 and 33 (C 3063 and DK 1933) are two small faience vessels which are also illustrated in Pl. CI, 10 and 8, respectively. They are described in Chapter XX on Stone and Faience Vessels.

No. 34 (SD 1535) is also illustrated in line in Pl. CLV, 43, and has already been described.

No. 35 (VS 990) is part of a cover-like object, which was formerly about 3 inches in diameter and 0·2 inch thick. Its base is flat and the upper surface roughly decorated with incised lines. It is made of a soft spongy paste bearing traces of a glaze which is now apple-green in colour. Level, 3 feet below surface.

Spindle-whorl. No. 36 (SD 2040) is a spindle-whorl made of a vitreous paste which is light blue in colour and glazed in blue and white, the latter of which may possibly have once been green. It is described in Chapter XXIV on Household Objects, Tools, and Implements. Level, 4 feet below surface.[1] From outside western wall of Block 7, Southern Buildings Section.

No. 37 (DK 2562) is again a fragment of a plaque-like object of a green, vitreous paste, measuring 2·05 inches wide by 0·15 inch thick. Its lower surface is flat and the upper part deeply scored with parallel lines. Level, 3 feet below surface. Street between Blocks 1 and 2, Section B, DK Area.

No. 38 (DK 2256) is a piece of a plaque, or a fragment of inlay, of some kind of vitreous paste, light blue in colour. It measures 1·7 inches in length and 0·25 inch in thickness. Level, 1 ft. 6 in. below surface. Room 17, Block 3, Section B, DK Area.

Grooved plaque. No. 39 (DM 226) is a very curious object, 1·7 inches wide by 0·23 inch thick. The two ends are missing. It consists of five tube-like pieces of faience joined together, the

[1] The blue on another piece of faience (HR 5842) was found to contain no trace of copper. Mr. Sana Ullah suggests that cobalt was used for the darker blue.

internal diameter of each tube being 0·15 inch. An exactly similar object, but still more badly broken, is seen in No. 46. Both objects were made of a sandy-looking white paste with traces here and there on the surface of a light blue or green glaze. The holes in these objects are much too small to hold an eye-paint, as did somewhat similar objects in ancient Egypt, nor do they contain any trace of colour. They are perhaps beads or spacers of unusual size. Level, 12 feet below surface. Stūpa Section, SD Area.

Whorls. No. 40 (DK 2948), which is a well-made spindle-whorl of a light blue, vitreous paste, is again described in Chapter XXIV on Household Objects, Tools, and Implements. As in the case of No. 36, glazes of two different colours were used on this whorl, one blue and the other probably green, which has now faded to white. Level, 3 feet below surface. Street between Blocks 1 and 2, Section B, DK Area.

No. 41 (SD 1894) and No. 47 (SD 1231) are similar spindle-whorls, which were both made of a soft white paste coated with a glaze which has faded to a light blue colour. They also are discussed in the chapter on Household Objects, etc. No. 41 was found in the clay packing between the two piers on the northern side of the Great Bath at a level of 6 feet below the surface. No. 47 comes from one of the cells on the eastern side of the same Bath. Level, 6 feet below surface.

No. 42 (HR 5536) measures 1·65 inches across and is 0·1 inch thick. The reverse is flat and undecorated. The glaze would seem to have once been green in colour. This object, which is a fragment of a larger piece of inlay, was found 6 feet below the surface of the ground. Room 8, House XVIII, Block 4, HR Area.

No. 43 (HR 4967) measures 0·7 inch wide. Both ends are missing. The reverse is flat and plain, the obverse rounded and fluted. It is made of a vitreous paste which is now white in colour. Level, 6 feet below surface. Room 95, House XIII, Block 2, Section B, HR Area.

No. 44 (HR 3607) is a fragment of a spindle-whorl that formerly measured 1·7 inches in diameter. Its reverse is flat and its obverse slightly rounded. The hole in its centre to accommodate the spindle is 0·15 inch in diameter. It was made of a soft white paste covered with a light blue glaze. Level, 3 feet below surface. Room 97, House XIII, Block 2, Section B, HR Area.

No. 45 (HR 5837) measures 0·85 inch wide. One end is perfect and the other missing. This object is a piece of inlay very similar to No. 43. Its flat base and rounded lower portion are provided with small holes to take a fine wire which helped to secure the inlay in the cement in which it was once set.[1] It is made of a vitreous paste that is now an apple-green colour. Level, 7 feet below surface. Room 44, House XXIX, Block 5, Section B, HR Area.

No. 46 (SD 1397), which measures 1·8 inches wide and 0·4 inch thick, is similar to No. 39. Both sides are missing. The small hole running through each pipe-like section is 0·15 inch in diameter. From one of the cells on the eastern side of the Great Bath. Level, 6 feet below surface.

Bracelet. No. 48 (SD 427) is a fragment of a bangle made of a vitreous, greenish-blue paste. The bangle was originally 3 inches in diameter by 0·3 inch thick, and is ornamented on the outside with a herring-bone pattern. Level, 4 feet below surface.

No. 49 (HR 4628). Fragment of a small faience vase made of a white paste. It still shows traces of its original green or blue glaze. Level, 4 feet below surface. From the open space, south of House XLVIII, Block 6, Section B, HR Area.

No. 50 (HR 5804). This is a portion of a bead of cylindrical form, measuring 0·5 inch

[1] The same procedure was adopted in early Sumer. Hall and Woolley, *Al 'Ubaid*, pl. xxxiii.

in diameter. Its sides are fluted. Made of a sandy-looking, white paste with traces of a glaze of greenish colour. Level, 2 feet below surface.

No. 51 (HR 5565). A fragment of a bangle made of a light green vitreous paste. High Street, N.E. of House I, Section A, HR Area. Level, 2 feet below surface.

No. 52 (HR 5894). Cylindrical bead with fluted sides, measuring 1·2 inches long by 0·5 inch in diameter. Made of a soft grey paste that was formerly covered with a glaze. Level, 9 feet below surface. Rooms 1 and 13, House XXIII, Block 2, Section B, HR Area.

Base of vessel. No. 53 (HR 2724). Hollow, cone-shaped object, measuring 0·9 inch high. Possibly the base of a model vase or offering-stand. There is a hole 0·1 inch in diameter through the stem that communicates with the concave base. It is made of a vitreous paste of a light green colour. Level, 5 feet below surface. From western side of First Street, HR Area.

Vitreous Paste

Vitreous paste. In the above descriptions of the faience and paste objects illustrated in Pl. CLVII, a vitreous paste has been alluded to as well as ordinary faience. This vitreous paste resembles glass in some respects. It has a smooth fracture and when examined through a magnifying glass frequently shows a number of air or blow-holes. It is opaque and is therefore not a variety of porcelain. It shows no evident impurities or admixture, as would be the case if a paste had been mixed with an ordinary adhesive to strengthen it.

Analysis. I give below the analysis of a sample of this vitreous paste by Mr. Sana Ullah, Archæological Chemist in India :—

	Per cent.
Silica	88·12
Alumina	3·2
Ferric oxide	1·82
Calcium Oxide	1·26
Alkali Oxides	5·04
Cupric Oxide	0·46
Total	99·90

The compounds were fired to about 1200° C.

Another analysis made by Dr. Hamid of a fragment of a small jar, light blue in colour and made of this vitreous paste (HR 3572), is as follows :—

	Per cent.
Silica	85·90
Ferric oxide and alumina	6·74
Lime	1·73
Magnesia	0·38
Alkalies	3·70
Oxide of copper	0·46
Loss on ignition	1·49
Total	100·40

Vitreous slabs. VS 195 is a fragment of an irregularly shaped slab of this vitreous material, of a cærulean blue colour. The paste had evidently been poured when in a viscous condition on to some flat surface, to which it had never adhered. The upper part of the slab is slightly rounded

and puckered in places owing to cooling. It was 0·25 inch thick, but its original dimensions cannot be obtained.

Another piece of vitreous paste (VS 1636) was also formerly a part of a similar slab. It is illustrated in Pl. CLIV, 2 and 3. It now measures 1·3 inches wide and 0·22 inch thick; the original length of the slab is not known. The fragment has the same general appearance as VS 195, but is of slightly lighter colour. It also has a rounded upper surface; but its base is flat and it was evidently poured out, or lifted when hot, on to a wire (?) screen, whose impression is clearly seen. Contraction would have separated the slab from the metal as it cooled.

The following is an analysis of VS 195 that was made by Dr. Hamid :—

	Per cent.
Silica	84·66
Ferric oxide and alumina	6·31
Lime	1·40
Magnesia	trace
Alkalies	5·48
Oxide of copper	0·97
Loss on ignition	1·18
Total	100·00

Mode of use. These two slabs are very similar in composition to the finished objects of vitreous paste. Possibly they were intended to be ground to a powder, like the modern enamels, and used for glazing purposes after a little soda had been added to serve as a flux. In practice, however, it was found that after grinding up a sample from the slab it was difficult to make the resulting powder adhere properly to a piece of steatite. This difficulty, of making such a powder adhere to the object to be glazed while being dried and before fusing, could have been overcome in several ways, as, for example, by mixing certain oils with the powder which volatilize at a high temperature, leaving no trace behind them.[1] Again, these slabs may have been heated in a flame to a semi-fluid condition and applied in that state to cover such articles as pottery beads and the like. A subsequent and prolonged heating of an object so treated would result in the glaze flowing freely over it. It appears to me that bead No. 50 in Pl. CXLVI was made in this way.[2]

Inlay decoration. An interesting piece of vitreous paste is illustrated in Pl. CLIX, 3 (HR 5843). This is a fragment of a vase of light blue paste. The surface was incised with a knife to a depth of about 0·15 inch, to form a pattern consisting of a broad band placed between borders of three narrower bands on either side. But no attempt was made to ensure any great accuracy in the width of the bands. The incisions were filled in with a paste that is now white, and this filling was then carefully pared down to make it exactly level with the surface of the vase itself. The vase was then fired at a high temperature. Both the paste of the filling and that of the vase itself were made of a fine, gritty-looking substance that seems to have been plentifully mixed with a glaze.[3] The resulting substances are opaque, vitreous materials with pittings here and there that are probably due to escaping gases. This particular piece resembles the many objects of vitreous paste that have been found at Mohenjo-daro

[1] I would instance pear-seed oil, frequently used for enamels at the present day.

[2] See Chap. XXVI, p. 516, for a description of this bead.

[3] For a description of the preparation of frits in Egypt, see Petrie, *Arts and Crafts of Ancient Egypt*, pp. 116–17. Also Lucas, *Ancient Egyptian Materials*, chap. ii.

and Harappā save for the inlay of another colour. It was unearthed from House XXXII, Block 5, Section B, HR Area, at a level of 2 ft. 4 in. below the surface.

Resemblance to glass.

The outward resemblance of this fragment to an opaque glass is very close; and it was probably still more so when the vessel was first made, for its colours have now faded badly owing to age and the salty nature of the soil in which it was found. But the granular nature of its paste proves it definitely not to be a glass.

Faience

Body.

The ordinary articles of faience are composed of a white or greyish paste coated with a glaze, which, presumably owing to the action of salt or damp, has generally faded to a light blue or green. This paste is granular in appearance and sometimes contains black specks, which may be the carbonized remains of an adhesive that it was sometimes found necessary to introduce to hold the paste together before it was dipped in, or painted with the glaze and fired.

From external examination two faience objects, both from the DK Area, the first being a broken-seated human figurine and the second the base of a small vessel, appeared to have been moulded from a crystalline, siliceous material like the faience of ancient Egypt. Dr. Hamid reports, however, that the body material of these two objects is steatite, which has all the appearance of having been artificially crushed. The technique of moulding, glazing, and firing in this particular case must have been essentially the same as in other faience objects. The relatively small proportion of water is significant, as it shows the effect of heat.

Dr. Hamid's analysis of this most interesting composition is given below :—

	Base. Per cent.	*Figure.* Per cent.
Silica	57·99	57·23
Oxides of Iron[1] and Aluminium	4·85	3·69
Lime	4·31	6·39
Magnesia	27·20	28·99
Alkalies	3·54	1·88
Oxide of Copper	1·09	0·46
Loss on ignition	2·01	1·36
Totals	100·99	100·00

Egyptian faience.

There has always been some doubt as to the material of the body used in the faience of ancient Egypt. It has been stated to be sand, powdered sand, carved sandstone, powdered quartz rock, ground quartz pebbles, etc.[2] But whatever the material used, it always contains over 90 per cent of silica. Mr. Lucas is of the opinion that crushed white quartz sand was the material employed.[3] No analyses have yet been made, to my knowledge, of early Babylonian faience.

It is questionable whether any added silicate had sufficient adhesive power to hold together the powdered steatite before it was fired.[4] Possibly, the object could have been extracted from its mould while still damp and, after being coated with the glaze, was heated

[1] The whole of the iron is expressed as Ferric Oxide.

[2] Lucas, *Ancient Egyptian Materials*, pp. 32 and 33.

[3] *Ibid.*, p. 33.

[4] It has since been proved by experiment that it does.

slowly in an increasing temperature until the fusing of the glaze firmly bound the whole mass together.

Powdered steatite. I do not think that the use of powdered steatite as a body material has ever been detected in the faience of Egypt. Objects cut from solid stone and then glazed are extremely common even in the earliest times in that country, and we find the same process frequently practised at Mohenjo-daro. From a technical point of view, the employment of ground steatite in place of carved steatite marks a great advance in craftsmanship ; it enabled objects to be readily duplicated in moulds with little expenditure of time or trouble.[1]

Moulding. Though faience objects were commonly moulded of this powdered steatite, it was found necessary to do a certain amount of work to them before the glaze was applied. The material is too coarse to be run into the moulds in a fluid state ; instead, it had to be pressed in. Fine details, such as the hair in the case of animal figures, were inclined to lose their sharpness in such a process, and it was found necessary to touch them up with some kind of tool.

In those objects whose glaze is well preserved it is found to be smooth and thin in the majority of cases, with no evidence of the over-firing that produces a slightly matt and even pitted surface.

Colours. We do not find the beautiful blues and greens that are so well known in Egypt ; but this is probably due to the exceptionally high proportion of salt in the soil of Mohenjo-daro.

Painted glaze. An interesting piece of faience is shown in Pl. CLIX, 4. This is part of a small jar (A 129). The paste of which it was made is a coarse, friable material, which was first bound together by some other material than the glaze. Its surface was then covered with a thin glaze, now light blue in colour, and ornamented by thin bands of a purplish-black. These bands were merely painted on the surface of the glaze, so thickly that they lie well above the surface of the jar. Judging from its texture and colour, this paint seems to consist of a frit coloured with manganese. Its present raised and blobby appearance may be due to fear on the part of the maker of the jar that over-firing would cause the bands to run and mix with one another.

Description. Dr. Hamid, who examined this fragment for me, states : "The dark bands consist of an easily fusible silicate glaze which owes its purple-black colour to the presence of manganese. It also contains iron which was probably present along with manganese in the natural ore employed as pigment. It was possible to prepare a sample for analysis from the interior of the body which seemed particularly free from glaze. No copper could be detected in it. It contains only traces of iron. The material is neither steatite nor pottery. From a preliminary analysis its composition seems similar to that of the material described as vitreous paste, though it is softer in nature and free from glaze."

Level, 3 feet below the surface. Room 13, Block 1, Section A, DK Area.

Glazed Pottery

Pottery bead. Two very interesting glazes covered the bead found in Room 18, House XV, Block 2, Section B, HR Area (HR 5026), that is illustrated in Pl. CXLVI, 50. It was at first thought that this bead was entirely made of glass, but a closer examination proved it to be pottery thickly coated with two coloured glazes, brown and white. While the brown is only a thin covering, the white glaze extends to a good depth in the body of the bead.[2] The former

[1] Though we have as yet found no moulds at Mohenjo-daro, it is certain that they were extensively employed in the manufacture of faience objects.

[2] See p. 516 *supra*.

seems to have been coloured with some form of iron.[1] Dr. Hamid has analysed this bead as follows :—

	Pottery base of bead. Per cent.		*The white glaze.*[2] Per cent.
Silica	71·12	Silica	86·28
Alumina	9·27	Alumina and Iron Oxide	7·78
Iron Oxide	10·91	Lime	2·35
Lime	1·77	Magnesia	0·61
Magnesia	1·55	Soda	1·21
Soda and Potash	3·77	Potash	nil
Loss on ignition	1·69	Loss on ignition	2·05
Total	100·08	Total	100·28

Mosaic glass.

The two sherds illustrated in Pl. CLIX, 1 and 2, look very like copies of mosaic glass, though no true glass has as yet been found either at Harappā or Mohenjo-daro. Both are made of a light-grey clay of medium thickness, well baked and fairly tough.[3] The dark, wavy markings are a purplish-black slip, which has been proved to contain manganese. It seems that these two pieces of pottery were first of all coated with this dark slip and then washed over with a glaze; but, before firing, the latter was partially removed with a comb-like instrument so as to leave a wavy pattern. This is an unusual technique, but it is seen on a painted pottery sherd lately found at Kish by M. Watelin.[4] On this sherd, also, a dark-coloured slip was painted and was subsequently partially removed in exactly the same way and with very similar results, except that the colour of the ground is different owing to the ware in this case being drab in colour. I am inclined to think that the sherd from Kish is of much the same date as the two pieces from Mohenjo-daro.

As some doubt had been cast on the possibility of these two pieces being glazed, they were sent to Dr. H. J. Plenderleith, of the British Museum, for further examination, and his report is given in Appendix II (p. 692).

Owing to their resemblance to some modern ware, these two pieces of glazed pottery were at first suspect, but during the season 1928–29 I have obtained certain proof that they are the work of the Indus Valley Civilization by the fortunate find of a third sherd of the same technique and colouring at an early level in the DK Area.[5]

No. 1 in Pl. CLIX (VS 195) was found at a depth of 2 feet below the surface of the ground in the VS Area, and No. 2 (HR 1114) at a depth of 5 feet in the HR Area. The third sherd comes from the north-west corner of House I, Block 1, Section A, HR Area.

Earliest examples.

These four sherds, which, it should be noted, came from different parts of Mohenjo-daro, appear to be the oldest examples of glazed pottery that have as yet been found in any country.

[1] The colour may have been green in the first place, subsequently ageing to brown.

[2] The term "glaze", here as well as in some other places, is used rather loosely for want of a better name for this substance, which though glassy in appearance is not a true glass—ancient glasses being essentially soda-lime silicates. It may be that in certain cases water saturated with carbonic acid is responsible for the removal of most of the alkalis.

[3] A certain amount of coarse white sand or quartz is present in the paste as well as a considerable amount of dirt, some of which has the appearance of charcoal.

[4] Now in the Ashmolean Museum, where it is stated to have been found in Area C, Kish, in 1929. This painted sherd shows no trace of glaze and it was the paint that was removed.

[5] This season (1929–30) has produced a fourth fragment, also from a low level.

Early History of Faience, Vitreous Paste, and Glass

Though we do not yet know with certainty in what country faience was invented, the archæological evidence at present available would seem to accord this honour to Egypt, where the glazing of various kinds of pastes as well as of stone was practised as early as pre-Dynastic times. It is possible, however, that the art was introduced into that country from the East. Faience beads first appear in what is known as the second civilization of the pre-Dynastic period of Egypt, which commenced about Sequence Date 38. Petrie would date this between 10000 and 8000 B.C.,[1] but others bring its latter end down to approximately 3400 B.C.[2] This question need not be discussed here, though in view of the fact that it must be referred to again later on, I would like to state that in my opinion a date between the two given appears to be more probable.

Invention of glaze.

The glazing of beads and other objects made of faience was certainly practised in very early times in Mesopotamia, for a number of faience articles were found at Jemdet Nasr near Kish,[3] in association with painted ware that has very close affinities with the painted pottery of Musyān and of Susa II. The date of this site and its painted pottery is still open to question, but there can be no doubt that it is as old as, if not older than, the pre-Dynastic period of Egypt. I would myself date it as early as 4000 B.C., if not some time before that.[4]

Early examples.

In Elam also, faience is associated with painted pottery and was made in very early times. It was probably first manufactured at about the same time as in Mesopotamia, for that the two countries were once occupied by similar civilizations is strongly suggested by the many similarities in their painted wares.

In the lower levels of Anau in Turkestān, faience is represented by a solitary bead which was found at the level of Culture III.[5] But possibly the salty nature of the soil at that site may be responsible for the wholesale destruction of glaze.[6] In the mixed layers, however, and also in association with the pottery of the younger culture of the South Kurgan at Anau, Pumpelly found fragments of faience which consisted of a glaze covering a white sandy body; these he compares with Egyptian faience. From the circumstances of their occurrence he was unable to deduce their actual provenance, though he definitely states that the possibility of their being of modern or mediaeval origin is not to be entertained.[7]

Anau.

The presence of the one bead in an early level by no means proves that faience was manufactured by the inhabitants of Anau. This solitary specimen may quite conceivably have been imported. Nevertheless, one suspects that even in early times the people of that site were well acquainted with faience ornaments, as the use of this material was so general in the Near and Middle East.

As the glazed objects illustrated in these volumes prove, faience was extensively manufactured in the Indus Valley; we find it as frequently in the lower as in the higher levels.

Common at all levels.

[1] Petrie, *Prehistoric Egypt*, p. 5.

[2] Peake and Fleure, *Priests and Kings*, p. 34.

[3] My account of these is shortly to be published by the Field Museum, Chicago.

[4] Langdon places the date of Jemdet Nasr about 3500 B.C. (*Oxford Editions of Cuneiform Texts*, vol. vii, p. iii), and Gadd the date of A-anni-padda of the First Dynasty of Ur about 3100 B.C. at the earliest (Hall and Woolley, *Al 'Ubaid*, p. 140). If, however, we compare the very archaic signs on the Jemdet Nasr tablets with the considerably more developed writing on the inscriptions of A-anni-padda, 400 years does not seem to me to be enough to allow for the difference between the two styles of writing.

[5] Pumpelly, *Explorations in Turkestan* (1904), vol. i, p. 160, pl. 42, fig. 8.

[6] In certain soils glaze entirely disappears.

[7] Pumpelly, *Explorations in Turkestan*, vol. i, p. 173.

And it is just as common at Harappā as it is at Mohenjo-daro. We have provisionally dated some of the lower levels of Mohenjo-daro to 3250 B.C., but there is no reason to doubt that faience will also occur in lower strata still at correspondingly earlier dates.

Nāl. A few glazed beads were found by Mr. Hargreaves at Nāl in central Balūchistān associated with painted pottery.[1] There is, however, some doubt about the date of this pottery; Sir Aurel Stein is inclined to regard it as later rather than prior to the painted pottery of the Indus Valley Civilization, despite the fact that its thinness and certain details of its decoration bring it into line with some of the painted pottery of Susa I.[2]

Crete. That faience as well as a kind of vitreous paste was known in Crete as early as the period E.M. II (approximately 2800–2500 B.C.) is proved by the finding of glazed beads and a faience bowl which was unearthed at Mochlos.[3] It is generally concluded that the art of glazing was introduced into Crete from Egypt in the first place, and that later its manufacture became established in the island itself. The colour is a pale bluish-green resembling that in use during the early dynasties of Egypt, with which it can be correlated in point of time.

Europe. It is only in comparatively late times that faience was manufactured in Europe, whither it seems to have been introduced indirectly from Egypt. Certain segmented glazed beads very similar to those illustrated in Pl. CXLVI, 28–30, have been found both in Egypt and Crete, dated in the former country as early as the eleventh dynasty—they are also common in the eighteenth dynasty—and in Crete to Period M.M. III–L.M. III. The same form of glazed bead has been found in many parts of Europe, including Wiltshire and even Scotland, and it is thought that in the British Isles they became a local manufacture. Sir Arthur Evans has devoted especial attention to this type of bead, of which a number are illustrated in his first book on Knossos.[4]

Mesopotamia or Elam. Taking into consideration the age of the faience objects found in the different countries, the available evidence points to either Egypt or Mesopotamia, with which I include Elam, as being the original home of faience. And owing to the large number of articles of this material that occur in Egypt, the honour of having invented faience has generally been conceded to that country. But it should be remembered that at present we know a great deal about the archæological history of that country and but little about that of Mesopotamia or Elam. The fact that faience was common at Jemdet Nasr, which up to the present is the earliest site that has been excavated there, and which from the nature of its painted pottery appears to be of a date prior to the pre-Dynastic period of Egypt, suggests, indeed, that the Egyptians borrowed the craft from either Mesopotamia or Elam.

Not invented independently. I cannot think that faience was invented independently in both Mesopotamia and Egypt. Its manufacture is a somewhat elaborate process and requires great attention to detail, first in the preparation of the glaze, then in its application, and finally in firing it in a muffle or kiln. Taking all this into consideration, it seems much more probable that the craft originated somewhere in the Middle East and thence gradually spread over the ancient world. The fine blues and greens that this material provides must always have been appreciated, especially for articles of adornment, for stones possessing these colours, such as lapis-lazuli and green-felspar, were expensive and in some countries difficult to procure.

[1] *Mem. Arch. Surv. Ind.*, No. 35, p. 34.

[2] Compare, for example, the pattern on a lyre found at Ur, dated to 3500–3300 B.C. (*Antiq. Journ.*, vol. ix, pl. xxxiii, fig. 1), with a design on some of the Nāl pottery (*Mem. Arch. Surv. Ind.*, No. 35, pl. xvii, figs. 36 and 39). These are almost identical except that in the Sumerian decoration there is a dot in the middle of the eye-shaped roundel. The decoration on the Nāl jars is, to my mind, a variant of the Ur pattern, and not very far removed from it in date.

[3] Evans, *Palace of Minos*, vol. i, p. 85.

[4] *Ibid.*, vol. i, pp. 491–3.

Proto-Babylonian culture.

It is significant that the second civilization of the pre-Dynastic period of Egypt, during which faience first appears in that country,[1] is supposed to have come from the East, though perhaps not from so far off as Mesopotamia or Elam. Petrie provisionally assigns the earlier home of this civilization to somewhere on the Arabian coast, whence it entered the Nile valley by the Koseir-Wādy Hammāmāt route.[2] The people who brought this civilization with elements of a proto-Babylonian culture[3] might quite well have been acquainted with the civilization of Mesopotamia and Elam, either direct or through intermediaries. Petrie has, indeed, suggested that they may originally have emigrated from Susa itself and have made a long halt at some point before reaching Egypt.[4]

In the above remarks I have assumed that the proto-Elamitic civilization was older than that of pre-Dynastic Egypt, a view that is held by Petrie and many others.[5] Indeed, further investigations will probably show that the former civilization had greater influence than has hitherto been supposed. That it also influenced the Indus Valley Civilization can hardly, I think, be questioned.

Glazed Pottery

Glazed pottery hitherto late.

Though we have seen that faience was extensively manufactured in ancient times, the glazing of pottery vessels appears to have been introduced in most countries at a much later date, probably for the reason that the glazing of comparatively large objects, such as pottery, is a difficult process. As I have already mentioned, the earliest examples of glazed pottery have been found at Mohenjo-daro. In Egypt it appears to be unknown before Roman times.[6] Yet in Nubia, Reisner is said to have found a large number of pieces of glazed pottery in a tomb dated to the twelfth dynasty, which appears to be of local manufacture.[7] If this ware is actually glazed pottery, it is curious that it had not appeared in Egypt by that time. In Mesopotamia, glazed pottery first appears about 1000 B.C., and was especially common at the time of Nebuchadnezzar.[8] In Crete, it has not apparently been found at all.

Kushān period.

It seems that glazed pottery disappeared for a time in India, but it came in again in the Kushān period (second century A.D.). From then onwards it seems to have survived down to modern times. Ross states that there is a tradition in India that enamelled pottery, by which I conclude he means glazed pottery, and which he calls a sumptuary art, was introduced from China through Persia.[9] Some would ascribe the invention of glazed pottery to China on the flimsy ground that, as that country invented porcelain, it must also have invented glazed ware. We as yet know little about the very early fabrics of that country, but it is said on good authority that even glazed pottery was not known in that country before the *Han* Dynasty (206 B.C.–A.D. 220), long after it was commonly used in Mesopotamia.[10, 11] There is, it should

[1] Glaze, except on stone, is unknown in the Badarian period. Brunton and Caton-Thompson, *Badarian Civilization*, p. 27.

[2] *Ancient Egypt*, 1917, pt. i, pp. 26–36. Petrie, *Prehistoric Civilization*, p. 49.

[3] *Camb. Anc. Hist.*, vol. i, p. 254.

[4] *Ibid.*, p. 256.

[5] *Ancient Egypt*, 1917, pt. i, p. 32.

[6] Lucas, *Ancient Egyptian Materials*, p. 58.

[7] *Ancient Egypt*, 1916, pt. ii, p. 87; also *Museum of Fine Arts Bulletin*, Boston, Dec., 1915.

[8] According to Harrison this was a lead glaze. Harrison, *Pots and Pans*, p. 53.

[9] *Land of the Five Rivers*, p. 44.

[10] *Ency. Brit.* (11th ed.), vol. v, p. 744: Ceramics. Dr. Andersson has not reported the presence of glaze in Chalcolithic sites in China.

[11] The Chinese appear to have obtained their knowledge of lead glaze from the West. Harrison, *Pots and Pans*, p. 53.

be noted, a very considerable difference between the processes involved in making porcelain and glazed pottery. The former is a vitrified clay of a special kind, whereas the latter is made by applying a glass-like material to an earthenware base.

Possibly foreign origin.

It is certainly interesting to find that glazed pottery was used in India before it appears to have been known in Mesopotamia. And it should be noted that the quality of the Indian sherds that I have just described is equal in finish to any glazed ware of ancient Mesopotamia. The four pieces found at Mohenjo-daro are beyond a doubt the handiwork of a potter who was well acquainted with the process and able to carry it to a high degree of perfection. From the fact that only four samples of this glazed ware have been found, we must conclude, at least for the present, that it was not extensively manufactured. Indeed, we cannot be certain that it was actually made in India; it may conceivably have been imported. We must, nevertheless, provisionally accept its Indian origin, for there is no other country known to us where glazed pottery vessels were manufactured at such an early date.[1]

Vitreous Paste

History.

The history of this material, which to the casual eye closely resembles an opaque glass, is at present obscure. At Mohenjo-daro it occurs as commonly as faience, and it was doubtless appreciated for its strength and the compactness of its paste. It can readily be moulded, and objects made of it, though simple in design, have their details well defined. I do not know if this substance has yet been found in Mesopotamia; I have seen no samples at Kish or elsewhere. In Egypt, a very similar material to that found at Mohenjo-daro was commonly used in the twenty-sixth dynasty; it is described by Petrie as "a beautiful hard stoneware, apparently made by mixing some glaze with the body, enough to fuse it into a solid mass throughout and with a fine and smooth surface without any face glaze".[2]

A variety of vitreous paste known as glass-paste is mentioned by Hall as being used in the manufacture of Cretan beads in M.M. III–L.M. I times. This substance, he states, was peculiar to the Minoans, and was not used in Egypt.[3] Possibly this is the same substance that Sir Arthur Evans describes as a vitrified paste, and which seems to be the same material as that manufactured at Mohenjo-daro.[4]

Possible Indian intervention.

For the present, therefore, we may surmise that this vitreous paste was an Indian invention and that it very slowly spread from that country. It is a distinct advance on faience, though I doubt whether its colour was always as fine, as it has little or no surface glaze.

Glass

Earliest glass.

As negative evidence is always useful, it is desirable to mention here that no true glass has yet been found either at Harappā or Mohenjo-daro, though the use of glass is not in reality far removed from the process of glazing pottery. The earliest examples of true glass that have been found up to the present come from Egypt. They include an impressed Hathor head found

[1] That small pottery objects such as beads were frequently glazed, is well known, both in early Egypt and Sumer. But technical difficulties may perhaps have prohibited its use in a larger way. For an example of a glazed pottery object of early date from Sumer, see Mackay, *Report on the Excavation of the "A" Cemetery at Kish*, pt. i, p. 43, pl. xviii, fig. 20.

[2] *Arts and Crafts of Ancient Egypt*, p. 116.

[3] Hall, *Civilization of Greece in the Bronze Age*, p. 198, note.

[4] Evans, *Palace of Minos*, vol. i, pp. 489–90.

in a pre-Dynastic grave [1] of Sequence Date 41, or the beginning of the second civilization, and glass beads from other pre-Dynastic burials.[2] The earliest specimen of glass as yet found in Mesopotamia was unearthed at Abu Shahrein by Hall, who found it in a deposit older than the third dynasty of Ur (*c.* 2300 B.C.).[3] The glass beads discovered by Herzfeld under the town houses of Samarra [4] may be of approximately the same date ; and Koldewey claims that certain vessels of mosaic glass found in Mesopotamia date back to the period when glass was in common use in Egypt (about 1500 B.C.).[5] These vessels may, however, have been imported. In Palestine glass appears in the Third Semitic Period (*c.* 1400–1000 B.C.), but it is thought to have been imported from Egypt.[6] Glass was unknown in Crete up to Middle Minoan times, when it was sparingly used for beads at the time of the twelfth dynasty of Egypt (*c.* 2200–2000 B.C.).[7]

Decorated Carnelian

Design in white

Nos. 43–5 in Pl. CXLVI illustrate three beads of especial technical interest.

No. 43 (VS 2546), also illustrated in Pl. CLVII, 9, is a carnelian bead of a beautiful translucent red colour with a design upon it in narrow white lines. These lines have been burnt into the stone, and the fine colour of the stone itself proves that it had been subjected to heat. Found in House XVII, VS Area, at a depth of 1 foot below the surface.

No. 44 (L 225) is also of red carnelian with a white line around the edge on both faces. It was found just beneath the surface of the ground in Chamber 114, Block 6, Section A, L Area.

No. 45 (SD 1198) is red carnelian covered with fine white lines. It was found in the passage west of Chamber 8 of the Bath Building, at a depth of 5 ft. 5 in. below the surface.

Rare at Mohenjo-daro.

These decorated carnelian beads, as they can best be described, are for some reason—which cannot at present be explained—very rare at Mohenjo-daro. In fact, only four specimens are known from that site.[8] The process by which the white lines were made to adhere so closely to the stone has already been explained in a short note that I contributed to the *JRAS*.[9] Carnelian beads treated in exactly the same way were found in a series of graves of pre-Sargonic date at Kish in Mesopotamia, though comparatively few in number.[10] I am told that the process is still carried on in the south of India,[11] where, however, it is a decaying industry.[12, 13]

[1] Petrie, *Prehistoric Egypt*, p. 43, (110); pl. ix, No. 47. It is suggested that it may have been imported.

[2] Maciver and Mace, *El Amrah and Abydos*, 1902.

[3] Hall, *The Civilization of Greece in the Bronze Age*, p. 71.

[4] Frankfort, *Studies in Early Pottery of the Near East*, No. 1, p. 61.

[5] Koldewey, *Excavations at Babylon*, pp. 255–6.

[6] Handcock, *Archæology of the Holy Land*, pp. 271–2.

[7] Evans, *Palace of Minos*, vol. i, p. 104.

[8] The fourth bead, which I have not yet seen, was found in the room west of chamber 46, House V, Block 2, of the HR area, at a depth of 6 feet below the surface of the ground.

[9] *JRAS*. 1925, pp. 689 sqq.

[10] Mackay, *A Sumerian Palace*, pt. ii, pl. lx, Nos. 54–8 and 62–3. In particular compare No. 62 of the above with No. 44, Pl. CXLVI of this work.

[11] Decorated carnelian beads are common on sites of the Scytho-Parthian and Kushān periods in the North-West of India.—[Ed.]

[12] Similarly decorated carnelian beads have been recovered by Sir Aurel Stein from sites between Khotan and Kan-chou. See Stein, *Serindia*, vol. iv, pp. 100, 117; pl. iv. The author also tells me that he has found several specimens on Chalcolithic sites of Makrān and Kalāt.

[13] The industry was carried on at Sehwān in Sind up to 35 years ago.

Imitation Carnelian

A few objects that are obviously imitations of decorated carnelian (Pl. CLVII, 8, 10, 11, and 12) have also been found at Mohenjo-daro.

Powdered steatite.

No. 8 (SD 1998) is a rectangular bead measuring 1·5 inches long by 0·35 inch wide and thick. It is made of a fine white paste resembling powdered steatite, and is marked with red bands. The red is a thick hæmatite slip that has been carefully polished. Level, 8 feet below surface.

No. 10 (HR 1797) is the same shape as the curious shell and alabaster objects found at Mohenjo-daro (Pl. CLVII, 56 and 57; Pl. CLVI, 2–5), with a wavy surface above and below, and sometimes perforated, sometimes not.[1] The object in question has an outside diameter of 0·95 inch, is 0·5 inch high, and the diameter of its hole is 0·43 inch. It is made of a white paste that contains a gritty material resembling quartz, and its outer surface is smoothly coated with a dark red hæmatite slip that has been carefully polished. Upon this slip somewhat irregular circles have been painted in white with three dots in the centre of each. It has also been mentioned in Chapter XXVI on Personal Ornaments, for despite the large diameter of its hole it may have been worn as a bead.[2, 3] Level, 6 ft. 6 in. below surface. Room 12, House VIII, Block 3, HR Area.

Decorated vase.

No. 11 (SD 1823) is a fragment of a small vase made of a white paste. Like No. 10, it also was coated with a smooth red slip upon which irregular lines in white were painted which recall the "scrabbled" markings on some of the painted pottery. From Block 4, Southern Buildings Section. Level, 8 feet below surface.

No. 12 (HR 1960) is very similar to No. 10, except that there are more dots inside its circles. It is but a fragment and its estimated outside diameter is 1·5 inches and inside diameter 0·85 inch. Its height is 0·68 inch. Found in Room 4, House VII, Block 3, HR Area, at a depth of 5 ft. 6 in. below the surface.

Bronze Cells for Inlay

In Pl. CLVIII, 3 and 7, and again in Pl. CXLIII, 9 and 10, two pieces of bronze are illustrated, whose cells were evidently intended to contain inlay. The larger piece, No. 7 (DK 2278), measures 1·55 inches across and 0·3 inch in thickness; the depth of each cell is 0·15 inch. Level, 4 ft. 6 in. below surface. Room 14, Block 2, Section B, DK Area.

No. 3 (DK 2279) is very similar except in its design, but is a smaller fragment. Level, 7 feet below surface. Room 4, Block 16, Section C, DK Area.

Inlaid materials.

In neither of these pieces is any trace of the inlay left, whether of glaze, stone, or shell. The first seems the most probable, as the inlay could be inserted in the cells in a pasty condition and fired in that position. Shell inlay would have required very careful cutting to make each piece fit closely to the cell, for which it was intended. I have not heard of inlay work of this description being found in Mesopotamia, but inlay with a stone backing was well known there in very early times. There is no reason, however, to think that the Sumerian did not sometimes also use metal for this purpose. In Egypt, moreover, especially in the Twelfth Dynasty, cloisonné work was practised extensively, the cells being formed by separate

[1] These last are probably unfinished.

[2] See *ASR.* 1902–3, pl. xxviii *b*, fig. 3, and p. 517 *supra*.

[3] Mr. Mackay's view that these objects may have been merely beads seems hardly tenable in view of their obvious resemblance to the ring stones illustrated in Pl. XIII, 9 and 10, and Pl. XIV, 6 and 8. See pp. 61–3 *supra*.—[Ed.]

pieces of flat wire instead of being cast. The former process may be a development of the latter, as it was probably found that when cast the walls of the cells could not be made of sufficient thinness.

Worked Agate

Two pieces of worked agate are of considerable interest. It is not possible, however, to illustrate them adequately, as their details are so fine (Pl. CXXXIII, 19 and 20).

Mode of working.

No. 19 (SD 872) is rectangular in shape and measures 2·7 inches long by 0·8 inch wide by 0·47 inch thick. One face shows the natural surface of the pebble; on a second it has been first flaked and then partially rubbed down; and the third and fourth faces were both carefully smoothed and polished. Level, 7 feet below surface.

No. 20 (SD 820) is roughly rectangular in shape, measuring 3·05 inches long by 0·9 inch wide by 0·55 inch thick. One side shows the natural surface of the pebble; on another side and at one end it has been flaked exceptionally finely and smoothly. On the two remaining sides the flaking has been removed by careful polishing. Level, 3 feet below surface.

For what purpose these two unfinished pieces of agate were to be used, it is difficult to say. Possibly they were intended for burnishers for metal work. On the other hand, what are undoubted burnishers have been found, and they are triangular in section (Pl. CXXX, 10, 32, and 36).[1] The fineness and regularity of the flaking in both pieces, which are of Intermediate date, is extraordinary; it shows a very high level of craftsmanship.

Proficiency in working hard stones.

In the working of flint, agate, and other hard siliceous stones the people of Mohenjo-daro were extremely proficient, as is proved by the chert weights, the two partially finished objects just described, the burnishers, and some of the harder stone beads. These materials were not, however, used for weapons, copper and bronze being used exclusively; and it is evident that these latter metals were both plentiful and cheap. Flint was, however, employed for ordinary domestic purposes; numbers of flakes (Pl. CXXXI, 1–16) were found in nearly every house, together with the cores from which they were struck.

Textiles

No textiles of any description are ordinarily preserved at Mohenjo-daro owing to the nature of the soil of that place, but adhering to the lid of the small silver vase illustrated in Pl. CXL, 3, a small piece of woven material was found which had been preserved by being impregnated with silver salts.

Report on cloth.

This fragment of cloth was submitted to Mr. James Turner, Director of the Technological Research Laboratory, Bombay, for examination, who remarks in his preliminary report that " The fibre was exceedingly tender and broke under very small stresses. However, some preparations were obtained revealing the convoluted structure characteristic of cotton. All the fibres examined were completely penetrated by fungal hyphæ. The appearance of one of the convoluted fibres is shown in the accompanying photograph (Pl. CLIX, 6 and 7). As this examination has been confined to a fragment measuring 0·1 inch in one direction by 0·3 inch in the other direction, these results can only be regarded as tentative.

Cotton.

(1) Fibre ; Cotton.
(2) Weight of fabric : 2 oz. per square yard.
(3) Counts of warp : 34's.
Counts of weft : 34's.
(4) Ends (warp threads) : 20 per inch.
Pock (weft threads) : 60 per inch."

[1] These burnishers are of chert.—[Ed.]

In conclusion, Mr. Turner states : " I would point out that the largest complete fragment recovered, when the paraffin wax was dissolved off, was so small that it is exceedingly difficult to attain certainty in the conclusions. However, I do not myself entertain any reasonable doubt that they are at any rate approximately correct." [1]

Egypt.

Egypt, which is now a great country for cotton, apparently did not produce this fibre in very early times. As far as we know at present, only flax and ramie were grown for the purpose of clothing. If cotton also had been woven in that country, it would have been noted before now, as owing to the extremely dry climate textiles, especially those from tombs, are exceptionally well preserved.

Cereals and Fruits

Wheat.

In Chamber 60, Block 2, Section D, L Area, a quantity of wheat (L 855) was found lying on a pavement of Late date. It was probably once contained in a basket which had entirely perished. This wheat, of which there was a considerable quantity, was whole, but badly carbonized.

Species.

A sample was examined by Dr. O. Stapf, late Keeper of the Herbarium, Kew, who reports provisionally as follows :—

" The grains show a remarkably wide range in size and shape, as if they had been derived from several strains. From a preliminary examination of the grains, I should say they represent a club-wheat (*Triticum compactum*), but the plumpest of the grains also approach *T. sphærococcum*. Both species are still in cultivation in the Punjab."

Professor Percival, of Reading University, has also examined this wheat. He reports that in his opinion it is the Indian dwarf wheat (*Triticum sphærococcum*).

A sample of wheat from the SD Area was also submitted to the same authority, who states it to be probably *T. sphærococcum*, but not quite typical. It may belong to a form of *T. compactum*, Host. The latter wheat is not now found in India ; it is, however, an old wheat, common in Afghānistān.

Barley.

Samples of barley from the HR Area have been identified by Professor Percival as *Hordeum vulgare*.

Earliest cultivation.

It is still uncertain whether barley was the first cereal to be cultivated by man. Both wheat and barley have been found in the earliest graves of Egypt. Samples of the former from early pre-Dynastic burials near Badari have been assigned to the " Emmer Group ", a species that possesses fourteen chromosomes and varieties of which have been found growing wild in Syria and Transjordania.[2]

The wheat found at Mohenjo-daro belongs to another group with twenty-one chromosomes known as " Soft Wheats ", which occur in a wild state in some parts of Persia.

Wheat from Jemdet Nasr.

Only one sample of very early wheat is known from Mesopotamia. This was found by Professor Langdon at Jemdet Nasr, but, unfortunately, there has been some controversy regarding its species.[3] Wheat found in the lowest levels of Anau in Turkestān has been identified by Dr. Schellenberg as belonging to the " Soft Wheat " group.[4]

[1] Since this was written Mr. Turner has been able to examine other samples of textiles from Mohenjo-daro and has published them in *Bulletin* No. 17, *Technological Series*, No. 12, *Indian Central Cotton Committee*, Bombay, to which the reader is referred. See also pp. 34 and 193 *supra*.

[2] Peake, *JRAI.*, vol. lvii (1927), p. 33.

[3] *The Times*, 29th Jan., 3rd Feb., 7th Feb., 1927 ; Percival, *Nature*, vol. cxix, p. 280.

[4] Pumpelly, *Explorations in Turkestan* (1904), vol. ii, pp. 472 and 473.

A species of barley (*Hordeum vulgare*) found in pre-Dynastic graves in Egypt is the same as that found at Mohenjo-daro. This barley is said to be a later species than the wild *H. spontaneum*, a native of Western Asia. Barley grains and glumes found adhering to a sun-dried brick from the lowest level of the North Kurgan at Anau have been identified as *H. distichum*, a species that approaches very closely to the wild type of barley.

Asiatic origin of wheat.

Mr. Peake, in his presidential address to the Royal Anthropological Institute,[1] remarks: "It is clear that wheat, and the practice of cultivating this grain, must have reached Egypt from Asia, where the plant is native." The same is probably true also of barley, but that cereal, owing to its more hardy nature, had possibly a much wider range than wheat; it will grow and ripen under conditions that would kill the more nutritious cereal.

Dates

Date-palm.

Some badly carbonized date seeds (VS 3627) were found in Chamber 37, House I, VS Area, showing that the date was known and presumably eaten in prehistoric Sind. The date-palm is not now a common tree in Sind; it is only sparsely grown in gardens. But in the Panjāb there are several localities where large groves exist, and also in Bahāwalpur State. There is, therefore, no reason to think that dates were imported from abroad in ancient times. If they had been, a likely source would have been the Bahrein Islands or other places in the Persian Gulf, such as Dilmun and Māgan, which are mentioned in the earliest Sumerian inscriptions as being famous for this commodity. As far as we can see, the date was not a principal article of food in early Sind, as so few date kernels have been found at Mohenjo-daro; but perhaps the damp soil of that site is responsible for their disappearance.

Medicines

Organic and sometimes inorganic substances also are subject to decay in the damp mounds of Mohenjo-daro, and by reason of this change they become practically indistinguishable from the soil in which they lie. Pieces of a coal-black substance, which is hard when dry and breaks with a shining black fracture, have been found in the DK and VS Areas and have long been a puzzle. This substance forms a dark-brown solution in water, which might lead one to think that it was some kind of ink.

Śilājit.

Mr. Sana Ullah, the Archæological Chemist in India, has now succeeded in identifying this substance. It is not an ink, but an ancient medicine called *Śilājit*, which is very largely used at the present day in India as a cure for various ills. It is said to be a specific for dyspepsia, diabetes, diseases of the liver and spleen, to regulate the action of the heart, and as a good respiratory stimulant and expectorant.[2]

Analysis.

The analysis of this substance made by Dr. Hamid is given in Appendix I (p. 690).

At the present day the name *śilājit* is given to two substances. One is white in colour and is a more or less pure native aluminium sulphate. The second is called black *śilājit* and is of quite a different nature. It exudes from the rocks, and, though it resembles a bituminous alum ore, there is vegetable matter mixed with it. It is this latter substance

[1] *Journ. Roy. Anthrop. Inst.*, vol. lvii, 1927.

[2] See Dr. Hem Chandra Sen in *Indian Medical Record*, 14th and 21st May, 1902.

that has been found at Mohenjo-daro. The localities in which it occurs are the lower, central, and upper ranges of the Himālayas, and it is brought down by various hill tribes for sale in the plains.

Śilājit may, of course, occur in other parts of the world. Prominence is given to it in this chapter, as it may have been exported anciently; and it may, therefore, be found on other sites of the Near and Middle East. If this be so, it may help us in tracing further trade connections with ancient India. This sample was found in the space south of Chamber 2, Block 1, Section C, DK Area, at a depth of 2 ft. 6 in. below the surface of the ground.

CHAPTER XXIX

SYSTEM OF WEIGHTS AT MOHENJO-DARO[1]

AMONGST the objects excavated at both Mohenjo-daro and Harappā are a large number of small rectangular blocks, mostly of a tawny or light grey banded chert, but also of other hard rocks such as gneiss. In one or two cases their form is cylindrical, but for the most part it is cubical. The blocks are well finished and polished, and are generally in a good state of preservation. None bears any inscription or mark indicating a value (Pl. CXXX, 25, 26, and 34; Pl. CXXXI, 20–35).

The results obtained from weighing these blocks show conclusively that they are weights belonging to a definite system, which is given in Table I.

In endeavouring to arrive at the most probable value of the unit, the only assumption I have made is that no one particular weight is more accurate than the rest, and that the probable percentage of error is the same for all. The loss due to chipping or wear of the edges in the specimens selected can rarely exceed 3 parts in 1,000, and in most cases is much less; the error due to this is therefore negligible in comparison with the variation of the different specimens of the same weight, which may evidently amount to as much as 10 per cent, though the mean deviation in a group hardly ever exceeds 2 per cent.

The assumption made by some metrologists that any given heavy weight, which happens to be in a good state of preservation and which, artistically speaking, has been made with care, can be taken as an accurate standard and that other weights can be derived from it as submultiples, is one which presupposes a knowledge of modern scientific method which is not justified by the evidence, particularly in the earlier periods.

The hypothesis of Ridgeway—a very reasonable one—that originally weighing was restricted to the more precious objects which would be bartered in small quantity, would lead us to expect the smaller weights to be the more accurate, and the evidence adduced in the tables shows much the same percentage consistency throughout the whole scale. The method of arriving at the most probable value of the unit was as follows: a casual inspection of the weights[2] showed that, with a few exceptions which were omitted, the weights fell into a series of groups which were in simple numerical ratios with one another. Giving the smallest the arbitrary value of unity, the others are in simple ratios, 2, 4, 8, etc. The mean weight of each group is divided by this ratio and multiplied by the number of specimens. The products for all the groups are added together and divided by the total number of specimens. This gives a mean value for the group of smallest weight in which every specimen weighed is allowed equal importance. The mean values for all the other groups are then obtained by multiplying

[1] In the Annual Report of the Archaeological Department for 1925–6, p. 92, Mr. Mackay stated that a large range of weights had been examined by the Archaeological Chemist with the object of ascertaining whether in their ratios they agree with the metrological systems of other parts of the Ancient East. I should like to take this opportunity of explaining that it was Mr. Hemmy and not the Archaeological Chemist who was the first to work out the system of these weights at Mohenjo-daro.—[ED.]

[2] The lists of weights are given at pp. 596–8. See also pp. 461–4.

this mean value by the ratio already found. In this way we arrive at the calculated values shown in column (7) in Table I.

TABLE I.—WEIGHTS AT MOHENJO-DARO

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation.	No. of specimens.	Mean weight observed.	Mean deviation.	Limits.	Ratio.	Calculated value.	Difference between Cols. 3 and 7.	Remarks.
N	1	1375 gm.	—	—	1600	1370 gm.	5	One weight in Class L is a corrected value.
L	2	272·95	2·25	270·70–275·20	320	273·92	—·97	
K	1	174·5	—	—	200	171·2	3·3	
J	6	135·97	·88	134·59–137·81	160	136·96	—.99	
H	6	54·21	·26	53·81– 54·50	64	54·78	—·57	
G	26	27·29	·24	26·85– 29·00	32	27·39	—·10	
F	32	13·79	·26	13·49– 14·90	16	13·70	·09	= 211·4 g.t.[1]
E	22	6·82	·09	6·31– 7·27	8	6·85	—·03	
D	9	3·40	·03	3·24– 3·51	4	3·42	—·02	—
C	9	2·28	·04	2·24– 2·33	⅓ × 8	2·28	·00	—
B	5	1·77	·06	1·69– 1·86	2	1·71	·06	—
A	1	·87	—	—	1	·856	·01	—

Out of a total of 120 weights selected for their good condition, only seven do not fall into the above table, and curiously enough these form another series, although the number is too small to base any important deduction upon it, *vide* Table IV.

The weights found at Harappā were treated in the same way, and the results are shown in Table II.

TABLE II.—WEIGHTS AT HARAPPĀ

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation.	No. of specimens.	Mean weight observed.	Mean deviation.	Limits.	Ratio.	Calculated value.	Difference between Cols. 3 and 7.	Remarks.
N	1	1375 gm.	—	—	1600	1376 gm.	— 1	M and N are corrected values.
M	1	546·7	—	—	640	550·4	— 3·7	
L	0	—	—	—	—	—	—	—
K	0	—	—	—	—	—	—	—
J	1	135·86	—	—	160	137·60	— 1·74	—
H	1	54·32	—	—	64	55·04	— ·72	—
G	13	27·55	·46	26·79–28·64	32	27·52	·03	—
F	9	13·86	·25	13·62–14·94	16	13·76	·10	—
E	4	6·84	·10	6·65– 6·98	8	6·88	— ·04	—
D	3	3·44	·04	3·39– 3·49	4	3·44	·00	—
B	1	1·70	—	—	2	1·72	— .02	—

[1] To avoid the confusion often found between the abbreviations for grams and grains, gm. is used for grams and g.t. for grains troy.

The above table represents thirty-four out of thirty-nine selected weights. The exceptions will be considered later.

This table shows an exactly similar series of weights to the former, and the mean value for unit weight *A* is ·860, which is practically identical with the value ·856 found for the unit weight at Mohenjo-daro. There is, therefore, no local variation between the weights in the two places, although 500 miles apart. We may, therefore, combine the results in the two tables and obtain Table III.

TABLE III.—WEIGHTS FOUND AT BOTH MOHENJO-DARO AND HARAPPĀ

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation.	No. of specimens.	Mean weight observed.	Mean deviation.	Limits.	Ratio.	Calculated value.	Difference between Cols. 3 and 7.	Remarks.
N	2	1375 gm.	—	1375	1600	1371 gm.	4	
M	1	546·7	—	—	640	548·5	— 1·8	
L	2	272·9	2·25	270·7 –275·2	320	274·2	— 1·3	
K	1	174·5	—	—	200	171·4	3·1	—
J	7	135·95	·77	134·59–137·81	160	137·1	— 1·1	—
H	7	54·23	·23	53·81–54·50	64	54·84	— ·61	—
G	39	27·38	·33	26·79–29·00	32	27·42	— ·04	—
F	41	13·81	·26	13·37– 14·94	16	13·71	·10	= 211·5 g.t.
E	26	6·82	·09	6·31– 7·27	8	6·86	— ·04	= 105·8 g.t.
D	12	3·41	·06	3·24– 3·51	4	3·43	— ·02	—
C	2	2·28	·04	2·24– 2·33	$\frac{1}{3}\times 8$	2·28	·00	= 35·3 g.t.
B	6	1·76	·06	1·69– 1·86	2	1·71	·05	—
A	1	·87	—	—	1	·857	·01	= 13·2 g.t.

In the above table are represented 147 out of 159 specimens which were considered in good enough condition to furnish reliable weights. Only three have been corrected, and these were large weights, the original form of which could readily be calculated from their dimensions.

The sequence of ratios is striking. Omitting group C, it runs as follows :—

1, 2, 4, 8, 16, 32, 64, 160, 200, 320, 640, 1,600.

There is not a sign here of the sexagesimal system ; all the ratios are binary or decimal (with the exception of the two weights in group C, which weigh one-third of those in group E).

There are certain exceptional weights found in both places. It appears more than a coincidence that the seven found at Mohenjo-daro should be themselves in the simple ratios 1, 2, 3, 4, 24, 48 (*vide* Table IV), but the number of specimens is too small to build much upon.

TABLE IV.—EXCEPTIONAL WEIGHTS AT MOHENJO-DARO

(1)	(2)	(3)	(4)	(5)	(6)
Designation.	No. of specimens.	Mean value observed.	Ratio.	Label.	Remarks.
U	1	47·30	48	DK 3176	—
T	1	24·50	24	DK 1411	—
S	2	3·92	4	VS 3058 DK 220	= 3·90 gms. = 3·93 gms.
R	1	3·03	3	DK 3183	(3·92 gm. = 60·6 g.t.)
Q	1	2·07	2	DK 2106	—
P	1	·98	1	VS 332	—

At Harappā No. 266, weighing 49·73 gm. was made of gneiss, but though the faces were in a state of high polish, the edges were rounded. It is probably a worn member of Group H. No. 1,184, weighing 3·96, is slightly chipped and, therefore, should weigh slightly above 4. It cannot, therefore, belong to Group D, but appears to be a member of Group S in Table IV. No. 3,556, weighing 3·12 gm., is of gneiss, and has its edges rounded. This is probably due to wear, and this weight probably belongs to Group D. B (g) 23, weighing 1·255, made of chert, is in excellent condition. It cannot be placed with any group.

A comparison was made with the weights found at different times and places in Iraq and at Susa.

Comparison with the Babylonian system.

The best collection of data available was that in the Memoir of M. Soutzo, in vol. xii of the *Délégation en Perse*. For a just comparison it was desirable to make an analysis of these weights in the same manner as above described. Weights described as being broken or in poor condition were omitted, whilst those of doubtful attribution or definitely aberrant are considered separately.

The weights belonging to the Babylonian light *mina* system are considered together in Table V; in Table VI are given those definitely marked as belonging to the Assyrian heavy *mina* system, and in Table VII those found at Susa which belong to the Babylonian system. As some of the smaller weights did not appear to be weighed to the nearest decigram, weights less than half a shekel were not taken into account in calculating the mean value of the unit from all the weights.

TABLE V.—LIGHT BABYLONIAN SYSTEM

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation.	No. of specimens.	Mean weight observed.	Mean deviation.	Limits.	Ratio.	Calculated value.	Difference between Cols. 3 and 7.	Remarks.
Talent .	1	29680	—	—	28800	30240	— 560	Weights in grams.
30 Minas .	1	14975	—	—	14400	15120	— 145	—
	2	2466	44	2422–2511	2400	2520	— 54	—
	1	1492	—	—	1440	1512	— 20	—
	4	970	13	946–995	960	1008	— 38	—
Mina . .	3	486	16	468–510	480	504	— 18	—
	6	246	2	240–248	240	252	— 6	—
	5	170	4	164–175	160	168	2	—
	6	82·8	1·5	80·2–85·5	80	84·0	— 1·2	—
	7	41·8	0·9	40–43·7	40	42·0	— ·2	—
	4	16·91	·44	16·45–17·70	16	16·80	·11	—
Shekel . .	11	8·31	·26	8–9	8	8·40	— ·09	= 129·6 g.t.
	16	4·37	·21	4–4·80	4	4·20	·17	—
	5	2·15	·10	2–2·30	2	2·10	·05	—
⅛ Shekel .	4	·96	·09	·80–1·10	1	1·05	— ·09	—

Mean value of Shekel = 8·40 gms. = 129·6 g.t.

TABLE VI.—HEAVY ASSYRIAN SYSTEM

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation.	No. of specimens.	Mean weight observed.	Mean devia-tion.	Limits.	Ratio.	Calculated value.	Difference between Cols. 3 and 7.	Remarks.
Talent .	1	60303	—	—	7200	60106	197	—
15 Minas .	1	14933	—	—	1800	15026	— 93	—
5 " .	1	5043	—	—	600	5009	34	—
3 " .	1	2865	—	—	360	3005	— 140	—
2 " .	2	1962	30	1931–1992	240	2004	— 42	—
1 Mina .	3	990	31	955–1037	120	1002	— 12	—
⅔ Minas .	1	666	—	—	80	668	— 2	—
¼ Mina .	1	237	—	—	30	250	— 13	—
⅕ " .	1	198	—	—	24	200	— 2	—
⅙ " .	1	178	—	—	20	167	11	—
⅛ " .	1	128	—	—	15	125	3	—
3 Shekels .	1	52·4	—	—	6	50·1	2·3	—
2 " .	1	36	—	—	4	33·4	2·6	—

Mean half large Shekel = 8·35 gm. = 128·89 g.t.

TABLE VII.—WEIGHTS ON BABYLONIAN SYSTEM FOUND AT SUSA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation.	No. of specimens.	Mean weight observed.	Mean devia-tion.	Limits.	Ratio.	Calculated value.	Difference between Cols. 3 and 7.	Remarks.
	1	10045	—	—	9600	10044	1	—
	3	4969	36	4985–5007	4800	5022	— 53	—
	2	2496	27	2469–2523	2400	2511	— 15	—
	1	2020	—	—	1920	2009	11	—
	2	1007	14	994 –1021	960	1004	3	—
Mina . .	6	504	6	495–519	480	502	2	—
	3	420	10	405–429	400	418	2	—
	3	342	4	335–345	320	335	7	—
	6	257	2	252–260	240	251	6	—
	9	165	5	158–176	160	167	— 2	—
	2	122	2	121–124	120	126	— 4	—
	12	82·4	2·7	76–86	80	83·7	— 1·3	—
	8	41·3	·8	39–43	40	41·8	— ·5	—
	2	33·5	·5	33–34	32	33·5	·00	—
	8	17·26	·46	16·50–18	16	16·74	·52	—
Shekel . .	20	8·45	·32	8–9	8	8·37	·08	= 129·2 g.t.
Double small Mina	5	5·50	·10	5·25–5·75	⅔ × 8	5·58	— ·08	—
Half shekel .	9	4·19	·17	3·80–4·50	4	4·18	·01	—
Small Mina .	6	2·77	·16	2·40–3·10	⅓ × 8	2·79	— ·02	—
	1	2	—	—	2	2·09	— ·09	—
	3	·95	·07	·85–1	1	1·05	— ·10	—

Calculated from the mean of all weights not less than a half shekel, the shekel = 8·37 gms. = 129·2 g.t.

It is clear that there is no special local variation in the shekel at Susa and that it is identical with that found in Iraq. Combining the results of Tables V, VI, and VII, we arrive at the result that the Babylonian shekel 8·38 gm. = 129·3 g.t. Comparing column (5) in Table III with the corresponding columns in these tables, we see that there is no overlapping anywhere except that one value of the ⅛th shekel at Susa, ·85, and one from Iraq, ·80, are less than the smallest weight, ·87, found at Mohenjo-daro, whilst Class C on the Mohenjo-daro system more or less overlaps the quarter shekel. The same succession of ratios from 1 to 32 of the actual weights used in the systems is worthy of note.

There are also certain approximations between the aberrant Indus Valley weights and those on the Babylonian system. These are shown in Table VIII.

TABLE VIII.—APPROXIMATIONS OF INDUS VALLEY WEIGHTS TO THE BABYLONIAN SYSTEM

Babylonian System.				Corresponding Indus Valley Weight.			
Locality. (1)	Cat. No. (2)	Weight. (3)	Attribution by Soutzo. (4)	Group. (5)	Cat. No. (6)	Mean wt. (7)	Limits. (8)
Hillah . .	— L.	·95	1/9 Shekel marked 22½	P	VS 332	·98	—
Niffer . .	959 C.	1·10	⅛ Shekel	—	—	—	—
" . .	— C.	1	"	—	—	—	—
Susa . .	55	1	"	—	—	—	—
" . .	12860	1	"	—	—	—	—
" . .	51	2	¼ Shekel	Q	DK 2106	2·07	—
—	— B.M.	2	"	—	—	—	—
Susa . .	12994	2·90	Small Mina	R	DK 3183	3·03	—
" . .	50	3·10	—	—	—	—	—
Many weights	from 3·80	to 4·10	½ Shekel	S	DK 220	3·93	—
Niffer . .	— C.	2·30	2/7 Shekel	C	—	2·28	2·24–2·33
" . .	— C.	2·20	"	—	—	—	—
" . .	— B.M.	2·19	"	—	—	—	—

The locality of discovery is given where stated, also the catalogue number in the Museum where the specimen is kept. (L = Louvre, C = Constantinople Museum, B.M. = British Museum.)

The weights of doubtful attribution or definitely aberrant found at Susa as well as in various places in Iraq have been tabulated by M. Soutzo. Omitting those which are stated to be damaged or in bad condition, we observe in the list fifty-three exceptional weights, of which thirty-two come from Susa. Quite a number of these approximate to weights found in the Indus Valley, and Table IX gives a list of these approximations. No Indian weight corresponding to the last item has actually been found, but, as the double of N would form a reasonable part of the system, it has been included.

TABLE IX.—APPROXIMATIONS OF ABERRANT WEIGHTS FOUND IN IRAQ AND SUSA TO INDUS VALLEY WEIGHTS

Iraq and Susa.				Indus Valley.			
Locality.	Cat. No.	Weight.	Attribution by Soutzo.	Group.	Cat. No.	Mean Weight.	Limits.
—	— C.	·80	⅛ Shekel	A	DK 140	·87	—
Susa	12859	·85	„	—	—	—	—
Niffer	959 C.	1·25	—	—	B (g) 23	1·255	—
„	959 C.	1·70	—	B	—	1·76	1·69–1·86
Susa	54	1·60	—	—	—	—	—
„	12827	3·50	—	D	—	3·41	3·24–3·51
Sippara	982 C.	3·45	—	—	—	—	—
Niffer	959 C.	3·45	—	—	—	—	—
—	— Berl.	3·36	—	—	—	—	—
Susa	56	6·80	Shekel (?)	E	—	6·82	6·31–7·27
„	42	12·40	2 Shekels (?)	F	—	13·81	13·37–14·94
„	14209	12·25	„	—	—	—	—
„	40	12·70	„	—	—	—	—
„	14206	13·20	„	—	—	—	—
„	32	13	„	—	—	—	—
Niffer	959 C.	14·70	—	—	—	—	—
Susa	28	29	—	G	—	27·38	26·79–29·0
Saida	1988 C.	47	5 Shekels (?)	U	DK 3176	47·30	—
Susa	37	138·7	1 Mina (?)	J	—	135·9	134·6–137·8
—	91437 B.M.	268	2 Mina (?)	L	—	272·9	270·7–275·2
Susa	1	272	„	—	—	—	—
„	10	271	„	—	—	—	—
„	7895	538	Mina (?)	M	421	546·7	—
„	13820	2769	5 Minas (?)	2 N	—	(2750)	—

We have here twenty-four, or omitting the two which coincide with aberrant Indian weights, twenty-two reasonably close coincidences of aberrant Babylonian weights (of which fourteen come from Susa) with the weights of the Indus Valley system. It may be noted that the greatest number of coincidences, six, and these nearly all from Susa, are with Group F, which is the group of which the greatest number of specimens have been collected. Nevertheless, I do not attach a great deal of importance to these coincidences. The proportional variation of weights in Susa and Iraq is much greater than at Mohenjo-daro, whilst the shapes are characteristically different. Those found in the west are either duckshaped or ellipsoidal, whilst those from India are all rectangular blocks.

It is a matter of interest to endeavour to discover whether the Indus Valley system of weights can be connected up with any particular grain.

It has been clearly shown, as in Ridgeway's *Origin of Currency and Weight Standards*, that the Babylonian system is based on the grain of wheat. The weight (= ·95 gm.) found at Hillah, marked 22½ grains, gives a value for the grain = ·042, but the fact that it is marked with a fraction shows that it has been derived from a higher multiple and that it is intended to be one-eighth of a shekel. This gives 180 grains to the shekel, a likely enough ratio on the sexagesimal system, and taking the 1–180th part of the mean value of the shekel, we arrive at the value ·047 for the grain, which is practically the same as that of the wheat grain, ·048 gm., which is three-quarters of the barley corn or grain troy, ·064 gm.

Starting from the mean value of Group E (= 6·86 gm.), we may divide by various round numbers which may seem likely or possible. The results are as follows :—

Dividing by	256,	dividend	= ·027
,,	200,	,,	= ·034
,,	180,	,,	= ·038
,,	150,	,,	= ·046
,,	128,	,,	= ·054
,,	100,	,,	= ·069
,,	80,	,,	= ·086
,,	60,	,,	= ·114

The values given in Ridgeway's book for various grains used in weighing are as follows :

Rice grain	= ·036
Wheat	= ·048
Barley	= ·064
Ratti	= ·113

The coincidence between the ratti and the dividend by 60 is tempting, but as there is no evidence in favour of a sexagesimal system, I am more inclined to prefer the relation between the rice grain and the dividend by 200.

Conclusion. A system of weights has been therefore discovered which is identical in Mohenjo-daro and Harappā. These weights are with hardly an exception uniform in shape, a rectangular block, cubical in the smaller sizes, and in the great majority of cases of the same material—a hard chert. They are well finished with polished faces and occasionally with bevelled edges. They are made with much greater accuracy and consistency than those of Susa and Iraq.

The system is binary in the smaller weights and then decimal, the succession of weights being in the ratios 1, 2, $\frac{8}{3} \times 8$, 4, 8, 16, 32, 64, 160, 200, 320, 640, 1,600. There is no evidence of a sexagesimal system, but between 1 and 32 we find a similar succession of ratios at Susa. The most frequently discovered weight, of ratio 16, has a mean value 13·71 gm. = 211·5 g.t., which shows no relation to the Babylonian shekel or its double.[1]

No inscription nor mark of value has been found on any of the weights. It is therefore probable (unless marks were originally painted on) that commercial transactions took place between classes of people who were completely ignorant of reading and writing.

APPENDIX I.—WEIGHTS AT MOHENJO-DARO

Cat. No.	Weight.	Designation, etc.	Cat. No.	Weight.	Designation, etc.
HR 4479	1375 gm.	N.	HR 4536	136·5	J.
HR 2390	266·06		DK 1227	135·38	Limits
	corner knocked off.		HR 636	135·28	134·59–137·81
	Corrected to		HR 19	134·59	Cylindrical.
	275·20	L.	DK 316	136·25	
VS 2678	270·7		DK 835	137·81	
DK 1910	267·55		DK 272	53·81	H.
	Slightly chipped		DK 1636	54·01	Limits
	omitted.		HR 4350	54·50	53·81–54·50
VS 35	174·5	K.	HR 4292	54·45	

[1] Sir Flinders Petrie has pointed out that this value comes within the range of the *beqa*. Egyptian weights of various designations, however, can be found of almost any value between 7·5 gm. and 14·25 gm., so that equality with one or another is more likely than not to occur; but the fact that the *beqa* is one of the earliest Egyptian weights may give some significance to the coincidence.

Cat. No.	Weight.	Designation, etc.
HR 4612	54·05	H.
HR 4621	54·45	
DK 3176	47·30	U.
DK 2767	27·21	G.
DK 1007	27·22	Limits
VS 2986	27·12	26·85–29·00
DK 1934	26·93	
DK 183	26·85	
HR 340	26·88	
HR 1683	27·50	
HR 2708	27·10	
VS 3493	27·30	
HR 154	27·29	
HR 4535	27·05	
VS 3451	27·25	
HR 2045	26·92	
HR 2207	27·30	
HR 5563	27·75	
HR 4941	27·45	
L 648	29·00	
VS 3267	27·40	
HR 5608	27·10	
VS 3184	27·10	
HR 5654	27·22	
VS 1006	27·35	
VS 1740	27·85	
VS 1879	27·15	
VS 1148	27·05	
VS 2172	27·25	
DK 1411	24·50	T.
Unmarked	13·54	F.
HR 2356	13·67	Limits
HR 2636	13·58	13·37–14·90
HR 2046	13·62	
C 3262	13·79	
DK 1269	13·62	
DK 1572	13·70	
DK 739	13·50	
DK 197	13·60	
DK 1207	13·64	
DK 2793	13·61	
DK 1872	13·91	
DK 2250	13·69	
DK 813	14·59	
DK 2012	13·67	
DK 909	13·49	
HS 975	13·59	
HR 4477	14·35	
HR 4460	13·95	
HR 5608	13·70	
HR 4388	13·62	
HR 4579	13·60	
HR 5602	14·41	
HR 3799	13·65	F.
L 208	13·37	
VS 1737	14·46	
VS 2083	13·62	
VS 2615	13·78	
VS 2074	13·85	
VS 2577	14·90	
VS 2281	13·70	
VS 1799	13·62	
VS 2879	6·87	E.
DK 1439	6·85	Limits
DK 529	6·83	6·31–7·27
DK 1643	6·82	
HR 2502	6·79	
HR 3873	6·92	
DK 643	6·80	
DK 535	6·31	
DK 326	6·73	
DK 1211	6·84	
HR 5800	6·76	
HR 3049	6·78	
HR 4499	6·83	
HR 3713	6·91	
HR 2852	6·89	
VS 3465	6·84	
HR 4445	6·87	
HR 5602	6·66	
VS 1281	7·27	
DK 1730	6·77	
VS 2259	6·76	
VS	6·87	
DK 220	3·93	S.
VS 3058	3·90	
DK 1428	3·44	D.
DK 232	3·24	Limits
DK 787	3·39	3·24–3·51
HR 2191	3·44	
HR 4284	3·43	
HR 3587	3·38	
HR 3029	3·30	
VS 2270	3·48	
VS 929	3·51	
HR 3183	3·03	R.
HR 4331	2·33	C.
HR 5079	3·24	
DK 2106	2·07	Q.
HR 3906	1·86	B.
HR 1872	1·81	Limits
VS 340	1·69	1·69–1·86
VS 2734	1·70	
VS 3495	1·79	
VS 332	0·98	P.
DK 140	0·87	A.

Appendix II.—List of Weights from Harappā

Cat. No.	Weight.	Designation, etc.	Cat. No.	Weight.	Designation, etc.
1642 [1]	1261 gm.	Poor condition.	3561	27·43	G. Gneiss.
	Corrected to	Cherty lime-	525	26·79	Grey slate, fair.
	1375	stone. N.	120	25·31	? Grey slate, fair.
421 [1]	492	Limestone; worn	1074	13·87	F. Chert.
	Corrected to	at edges only.	874	13·67	
	546·7	M.	120	13·62	
771	135·86	J. Chert; corners,	120	13·71	
		slightly	1173	13·81	
		chipped.	120	13·90	
771	54·32	H. Chert; corners	278	14·94	
		good.	1575	13·64	
266	49·73	? Gneiss; edges	185	13·62	Brown steatite.
		worn.	B (g) 22	6·90	E. Chert.
3663	28·21	G. Chert.	817	6·65	
1356	27·28	"	2585	6·82	
1356	27·68	"	2928	6·98	
855	27·30	"	1184	3·96	S. Chert, chipped.
2550	27·35	"	1708	3·49	D. Chert.
B (g) 14	28·62	"	120	3·39	
A (f) 284	27·40	"	A (e) 155	3·43	Steatite.
A (e) 155	27·06	"	3556	3·12	? Gneiss, edges
A 757	27·01	Gneiss.			rounded.
854	27·33	Chert.	3831	1·70	B. Chert.
645	28·64	"	B (g) 23	1·255	? Chert, good.

A number of objects of different shapes were weighed, but furnished no evidence of being weights. One (No. 78), however, may be mentioned as a possible exception. It was of sugar-loaf form, carefully shaped, with two round holes pierced near the top and meeting in the middle, through which a rope could be reeved or the weight lifted by the fingers. The material was grey limestone and the weight was 7,900 gms, which bears no obvious relation to the system worked out above. It was found at Nāl, in Balūchistān.

[1] Recalculated from density determination and measurement of dimensions.

Chapter XXX

HUMAN REMAINS

Introduction

Condition of bones and method of preservation.

THE human remains that have up to the present time been excavated at Mohenjo-daro appear to belong to widely separated periods of time. The full account of the excavations and of the finding of the various remains have been given elsewhere, and we have, therefore, in the following account confined our remarks almost entirely to the consideration of the anatomical features of the various skeletons and skulls that have been brought to light. These remains have very kindly been entrusted to us for the purpose of examination and report by Sir John Marshall, to whom we tender our sincere thanks. Of the various skeletons that have been found, No. 1 is of comparatively recent date, but the majority of the others are of considerable antiquity. In the majority of cases the bones were extremely fragile, and in their general appearance and conditions very closely resembled the human remains that were excavated at Nāl in Balūchistān,[1] and also certain other bones which were brought back by Sir Aurel Stein from the Makrān region and were also entrusted to us for examination. Owing to the nature of the soil in which these remains have been lying, the bones were strongly impregnated with saltpetre, and, as a result, decay and disintegration of the bones set in at once, and proceed with great rapidity the moment the remains are exposed. In most cases the bones were so delicate that it was found impossible to handle them for the purpose of examination or of taking measurements, until they had been treated with a solution of shellac dissolved in pure alcohol; owing to the amount of saltpetre with which the bones were impregnated, it was found necessary to repeat the process on several occasions, so that the shellac might become thoroughly distributed throughout the whole thickness of the bone, and, in addition, form a complete coating over the whole surface. Unless this coating is complete, it is found that, owing to the seasonal changes in the climate, the saltpetre tends to crystallize out and splits the bone in much the same manner as it causes flaking in the exposed brickwork of the buildings. In the majority of the skulls their condition was so delicate that we felt it to be undesirable to attempt to remove the impacted earth from the cranial cavity, especially in those cases in which parts of the skull were missing; we were thus forced to impregnate the whole mass with the shellac solution and then treat the objects as if they were fossils.

The bones themselves, prior to treatment with shellac, were usually of a pale pink or fawn colour, possibly due to the presence of iron in the soil; in this respect they closely agree

[1] Sewell and Guha, "Report on the Bones excavated at Nāl": *Mem. Archæol. Survey of India*, No. 35: *Excavations in Baluchistān*, Appendix V, 1929.

with the remains from Nāl. Similarly, the general character of the bones indicates that in the present case also there have been considerable changes in the chemical composition of the bones; the organic matrix has long since completely disappeared, and the salts themselves have changed.[1]

Number of skeletons and circumstances of their finding and examination.

The total number of individuals represented in the collection is twenty-six, and of these twenty-two were the remains of complete bodies, while three are represented by the skulls alone. Seventeen of the skeletons were excavated by Mr. Hargreaves during Sir John Marshall's excavations of 1925–6, and he has very kindly supplied us with a copy of the field notes that he made at the time that the excavation was being carried out. In compiling the following report we have made free use of these notes.

The skeletons or skulls are numbered in the order in which they were discovered. Of the first seventeen to be unearthed, numbers 1 to 4 were in all probability true burials; numbers 5 to 16 were found lying together in a small room, and appear to be "more like evidence of a tragedy than a form of burial, for the intermingling of the skeletons points to simultaneous interment" (Hargreaves). In addition to this group, a further group of six skeletons was discovered at another site, this time in one of the streets; and this, too, seems to have been the result of a tragedy.[2] This second group was discovered in the 1925–6 season, and one of us (B. S. G.) immediately proceeded to Mohenjo-daro, and, as it was decided to leave the skeletons *in situ*, treated them with shellac solution in the hope that they might be preserved; the following year it was decided to remove them, and in March one of us (R. B. S. S.) proceeded to the site, but it was found that, owing to exposure and in spite of the shellac treatment, the skeletons had deteriorated to such an extent that it was impossible to save more than a few fragments. A few additional measurements were taken, and these are given in the report below. The measurements taken by us on the skulls were taken according to the Frankfort Agreement. In the case of all additional measurements the technique followed has been described in the body of the text or full reference has been given.

Measurements taken by Camp Medical Officer.

Included in Mr. Hargreaves' notes there are a number of measurements taken on the first group of skeletons, while still *in situ*, by the Camp Medical Officer. Mr. Hargreaves remarks "having no instruments could not take correct measurements of the bones, but the young Indian Camp Medical Officer did his best with an ordinary tape measure". We have converted these measurements from inches to millimetres, and we give them in the following account, as, although possibly not absolutely correct, they give certain indications regarding the stature and physique of the individuals. In calculating the living height of the various individuals concerned, we have made use of the formulæ given by Manouvrier[3] and Pearson,[4] but in certain cases the result is not very satisfactory.

Skeleton No. 1

Description of skeletons.

This is a complete or nearly complete skeleton, and is in an excellent state of preservation. The body lay on its left side; the arms were bent and appear to have been placed so that the left hand was under the head and the right in front of the face. From the general condition of the bones and taking into consideration the rapidity with which bones

[1] Sewell and Guha, loc. cit., p. 60.

[2] For further particulars regarding these skeletons, see pp. 79–81, 107–8, 184–6, and 222–3.

[3] Manouvrier, *La détermination de la taille après les grandes os des membres*, Mem. de la Soc. d'Anthropol. de Paris, 1893.

[4] Pearson, Karl, "Mathematical Contributions to the Theory of Evolution, V: On the Reconstruction of the Stature of Prehistoric Races": *Phil. Trans. Roy. Soc. London*, vol. cxcii, p. 169.

become changed, especially in such a locality as Mohenjo-daro, where the effect of the saltpetre in the soil is remarkably destructive, it seems probable that this skeleton is at the most only a few hundred years old, if, indeed, as old as that.

Apart from the position in which the skeleton appears to have been lying, namely in the "embryonic" position, and on its left side, a position characteristic of the early burials of the "Mediterranean" race, another very interesting discovery, made during the process of cleaning away the adhering earth in which the skull was embedded, was the presence of a flat stone close up against the basis cranii at the back of the posterior nares. We have previously,[1] in our report on the human remains excavated at Nāl in Balūchistān, called attention to the presence in the skull from that site of a flat stone, that appeared to be an artifact, in the same position, namely behind the posterior nares, and we there discussed at some length the possibility of such an object having been deliberately placed there, either just before or after death, as a part of the death-ceremonies of these early inhabitants of India. A similar find in the present instance is particularly interesting, and, if part of the death-ceremony, would, in combination with the embryonic position of the body, indicate that certain death ceremonies must have persisted in this area for several thousand years. Associated with this skull were a number of other parts of the skeleton. Unfortunately, neither femur was intact; but there were present both humeri, both radii, and a tibia and fibula. We have, therefore, a fairly satisfactory basis for the estimation of the living height of the individual. In the following table we have given the heights as calculated from Pearson's tables and from Manouvrier's :—

Bone.	*Length in mm.*	*Calculated living height*	
		Pearson.	*Manouvrier.*
(*b*) Humerus Right	296	1529·934	1558·4
(*b*) " Left	294	1524·426	1553·4
(*c*) Tibia (with spine) . . .	366	1588·110	—
" (without spine) . .	358	1589·756	1624·0
(*d*) Radius	224	1561·072	1595·0
(*g*) H + R	—	1534·27	—
(*h*) H and R	—	1532·656	—
Fibula	348	—	1608·6

The letters in the first column refer to the particular formula given by Pearson. From the resulting estimates we find that there is a variation in the calculated living height between 1524·426 and 1589·756 according to Pearson's formulæ, and between 1553·4 and 1624·0 according to Manouvrier, differences of 65·33 and 70·6 respectively. The average living heights as given by the two methods are 1551·46 and 1587·88 mm. If we adopt the former figure, we can then calculate the proportional length of the two parts of the upper extremity, the upper and lower arms, with regard to the total height of the body. The figures reached are as follows, and for the purpose of comparison we have also given certain other figures, taken from Martin,[2] of the proportional lengths in the living persons of those races that seem most nearly to agree :—

Race.	*Length proportional to the living height of*	
	Humerus or Upper arm.	*Radius or Lower arm.*
	Per cent.	*Per cent.*
Mohenjo-daro (skeleton 1) ♀ . .	19·01	14·43
Polish Jew ♀	18·90	14·40
Badener ♀	19·10	14·40

[1] Sewell and Guha, loc. cit., p. 61.

[2] Martin, Rudolf, *Lehrbuch der Anthropologie*, 2nd ed., vol. ii, pp. 391–3, Jena, 1928.

Skeleton No. 2

This skeleton lay with the head towards the east and the face to the south. As in the case of No. 1, the body lay on its left side and the arms were bent so that the left hand was beneath the head and the right in front of the face. With the exception of the head of the right femur, which was still in the acetabulum, the bones of the lower extremities were missing. The skull is badly broken and a large part of the facial region is absent.

Skeleton No. 3 (13*b*)

This skeleton is represented by the skull only.

Skeleton No. 4

No portion of this skeleton has been received by us.

As mentioned above, Skeletons Nos. 5–16 all lay together in a group.

Skeleton No. 5

The body lay face downwards with the head towards the west and the legs of Skeleton No. 6 passed across the lumbar region. The skull was badly smashed and is too much broken to enable us to give any details of its characters.

Skeleton No. 6

This lay on its left side, with the head towards the south-west. The left arm was extended by the side and the right arm flexed, with the hand over the abdominal region ; both legs were somewhat flexed. The skull is in a good state of preservation. Mr. Hargreaves' notes give the following details regarding the proportions of the limb bones :—

Length of femur . .	440 mm.
Length of tibia . .	360 mm.
Length of fibula . .	365 mm.
? Length of humerus . .	350 mm. (upper end to external condyle)
Length of clavicle . .	143 mm.
Length of radius . .	225 mm.
Length of ulna . .	241 mm.
Length of foot . .	224 mm. (from the os calcis to end of 1st toe)

From these measurements we can roughly calculate the total height of the individual from the formulæ given by Pearson and Manouvrier respectively. The results thus obtained are given below in tabular form and we have again used the same letters for Pearson's formulæ that he makes use of in his paper :—

After Pearson.	*After Manouvrier.*		
		Length.	*Calculated height.*
(*a*) 1644·02 mm.			
(*b*) 1725·10 „			
(*c*) 1646·75 „	Femur .	442 mm.	1658 mm.
(*d*) 1601·77 „	Tibia .	362 „	1654 „
(*f*) 1644·63 „	Fibula .	367 „	1675 „
(*h*) 1716·83 „	Humerus .	352 „	1754 „
(*i*) 1687·29 „	Radius .	227 „	1616 „
(*k*) 1679·99 „	Ulna .	245 „	1605 „

The calculated living height thus ranges from 1601·77 to 1725·10 according to Pearson, and from 1605 to 1754 according to Manouvrier. In each case the result obtained by calculation from the length of the humerus is much greater than in the case of the other bones, and of course the same exaggeration is seen in all those formulæ of Pearson in which the length of this bone appears. Excluding the results thus obtained and taking only the rest that appear to agree fairly well, we reach estimates of the living height of this individual of 1661·35 according to Pearson, and of 1641·6 mm. according to Manouvrier, which corresponds approximately to a height of 5 ft. 4½ in. to 5 ft. 5½ in.

Skeleton No. 7

This skeleton lay on its back with its head pointing towards the south and the face turned to the west. The legs were flexed and the thighs abducted. The right leg lay across the fore-arm of No. 11 and the bend of the left knee across the right elbow of No. 8. The Camp Medical Officer gives the following measurements :—

Occipital condyle to promontory of sacrum .	369 mm.
Length of femur (upper extremity of head to internal condyle)	345 „
Length of fibula	276 „

From the above measurements it is clear that the height of this individual was much below the average. Taking the length of the sacrum as approximately 19 per cent of the total vertebral column, the whole length in this individual must have been somewhere in the neighbourhood of 435 mm., whereas the average height of the whole column in the adult male is 690 mm. and in the female 675 mm. The length of the femur would correspond to a living height of 1302 mm. and the fibula to a height of 1269 mm. or an average of 1285·5 mm. This corresponds to a height of 4 ft. 2·6 in.

Skeleton No. 8

This was found close to No. 7, with the head towards the north. The body lay face downwards with the legs extended and the arms bent and flung forward, the right wrist being in close proximity to the top of the cranium. The skull is in a fair state of preservation, but owing to the position in which it has been lying, it has become very much distorted, and the whole of the right side of the face has been pushed backwards and flattened.

Skeleton No. 9

The remains of this skeleton were much decayed and the skull is badly broken. The body lay north and south, with the head towards the south ; the right leg was extended and the left flexed at the knee ; the left arm was flexed with the hand on the lower part of the chest, and the right arm bent at the elbow with the hand resting on the pelvis (right os innominatum) of Skeleton No. 8.

Skeleton No. 10

This body lay in the north corner of the room in a line running from north-east to south-west, with the head towards the south-west. The body lay on its face with the head turned towards the left shoulder ; the legs were extended, but both arms were flexed. The left

fore-arm as well as both feet were missing. The Camp Medical Officer gives the following measurement :—

Length of femur (upper extremity of great trochanter to the external condyle) . . . . . 382 mm.

This would correspond roughly to a total length for the whole bone of 396 mm., and calculated from this figure the living height must have been approximately 1493 mm. or 4 ft. 10·8 in.

Skeleton No. 11

This was found close to No. 10, the body lying in a north and south direction, the head towards the south and the face turned to the west. The body lay in line with No. 8, the heads being about 14 inches apart. The arms were outstretched at right angles to the trunk and the fore-arms were flexed at a right angle ; the left leg was extended and the right leg flexed. The right hand lay between the feet of Skeletons Nos. 6 and 13, and the left fore-arm was beneath the right leg of No. 7. The skull is not quite complete, the temporal region of the right side being absent, but otherwise it is in a good state of preservation. The Camp Medical Officer gives the following measurements :—

		Living height.	
		Manouvrier.	*Pearson.*
Length of tibia	340 mm.	1568	1547·4
Length of fibula	328 „	1544	—
Transverse diameter of the pelvis . .	142 „	—	—

Here, again, there is considerable difference between the living heights calculated from the two bones. The length of the tibia, according to Manouvrier, corresponds to a height of 1568 mm., while, according to Pearson, it would be 1547·4, whereas that calculated from the fibula is only 1544 mm. Taking the mean of these three estimates the living height would be approximately 1553 mm. or 5 ft. 1 in.

Skeleton No. 12

This was found near to Skeleton No. 16 and in line with No. 6. The sole remains that were recovered are the skull, which is very badly broken, portions of the mandible and a few fragments of other bones. The skull was lying face downwards.

Skeleton No. 13

This was found lying east and west with the head towards the west. The body was on its left side, with the legs slightly flexed. The right arm was missing and the left much damaged ; it was touching the head of Skeleton No. 14.

Skeleton No. 14

This was lying close to and on the north side of No. 13. Only the skull and part of the vertebral column were preserved, but it appears that the body was lying on its back, with the face upwards. The skull is that of a child.

Skeleton No. 15

This was discovered at the extreme south end of the group lying to the south of Skeleton No. 5. The remains are stated to have consisted of a small crushed skull in poor condition, and apparently this was not sent to us.

Skeleton No. 16

This was lying to the west of Skeleton No. 5 and close against a wall. It lay with its head towards the north and the right arm extended between the feet of No. 8 and the head of No. 5. The bones were in a very poor and friable condition and the skull badly crushed.

Skeleton No. 17

This skeleton was discovered at a depth of 4 ft. 2 in. in a narrow lane, subsequently termed " Deadman Lane ". The body lay on its back and was lying in a north-west south-east line across the corner of a wall. Only part of a skull and the bones of the thorax were discovered. These were all in a poor condition and were not sent to us for examination.

Skeleton No. 18

Fifteen inches to the west of No. 17 a few fragments of a small skull were obtained, but no other remains of this individual were traceable.

The remains of the above skeletons were sent to us for examination in 1926 and with them there was, in addition, part of another skeleton which we have termed M. These fragments consist of a skull, in which the right parieto-temporo-sphenoidal region is missing ; part of the upper jaw ; the mandible in two halves and with the left coronoid and condylar processes broken off ; and a few other small bones, etc.

Skeleton No. 19

This was discovered during the course of excavations in 1926–7. All that was recovered was the skull with the lower jaw. Judging from the condition of the bones and the character of the teeth, which are not at all worn, this skull belongs to a later period than the remains found in the group Nos. 5–16 and those in the separate burials Nos. 2–4 ; but it is probably considerably older than No. 1.

In 1925–6 a second group of skeletons was discovered, as has been mentioned above (*vide supra*, p. 600). This group included the remains of six individuals and were found lying in one of the streets.

Skeleton No. 20

This was lying on its face, with the head pointing towards the south and with both arms extended in front of the head. The skeleton measured 5 ft. 5½ in. as it lay. The skull, of which much of the vault and the supra-occipital region is missing, is otherwise fairly well preserved. The following additional measurements were taken on what remained of the body :—

Length of femur (from condyles to top of great trochanter) 448 mm.

This corresponds approximately to a total length for the femur of 456 mm. Applying Manouvrier's formula this would give as the living height 1682 mm. or 5 ft. 6·2 in.

Skeleton No. 21

This lay between the legs of Skeleton No. 20, the head pointing at an angle of 28 degrees west of south. The body lay on its back. Only the skull, which was much eroded and broken, the upper part of the vertebral column, and the right scapula were left. All the rest of the skeleton had completely disintegrated. The skeleton appeared to be that of a child.

Skeleton No. 22

This individual lay to the east of No. 20, close to a wall. The body lay on its back with the head directed towards a line 28 degrees west of south and in line with the pelvis of No. 20. The right arm was flung upwards beyond the head and the left lay at the side. Both legs were somewhat abducted. The skull was badly smashed, and the whole skeleton disintegrated beyond hope of recovery.

Skeleton No. 23

To the south of No. 22 lay the remains of another body, again face downwards with the head pointing in a direction 7½ degrees west of south. The left arm was flung forward and the legs were nearly straight. The right arm was completely missing. Here, again, the bones had disintegrated very badly and the skull was completely smashed. The skeleton was remarkable for its size ; it appeared to be that of an adult male and the total height was 6 feet, measured from the top of the cranium to the os calcis.

Length of tibia (from spine to border of articulation with astragalus) 423 mm.

According to Manouvrier's tables this would give an approximate living height of 1841 mm., while according to Pearson it would be 1836 or 6 ft. 0·5 in.

Skeleton No. 24

About 3 ft. 8 in. from Skeleton No. 23 and a little to one side of it lay another, that seems to have been also that of an adult. This skeleton lay on its back, with the legs, of which parts are missing, slightly abducted. The left arm was outstretched at right angles to the trunk, and the right flung upwards above the head and bent at the elbow at a right angle. The maximum length of the humerus was 328 mm., which gives a calculated length for the whole body during life of 1671 mm. or 5 ft. 5 in.

Skeleton No. 25

This was the remains of a child and was lying on its back with, as usual in this group, its head towards the south. The legs were somewhat abducted, and the left arm appeared to have been outstretched at right angles to the body. The whole skeleton was in the last stages of disintegration.

Skeleton No. 26

This skeleton is represented by the skull only, which was badly crushed and consisted of a number of fragments.

Description of selected skulls.

From the above collection of human remains we have been able to select twelve skulls, that were sufficiently well preserved or at any rate not too greatly damaged to render reconstruction impossible, and from these to take measurements of a more or less reliable character and draw

deductions from them. It must, however, be borne in mind that some of these skulls have undergone a certain amount of posthumous deformation owing to the pressure of the super-incumbent earth, and this process has probably also been assisted by the deterioration of that part of the skull that lay below. It has been shown that in these early burials and interments that side of the skull that lay underneath in contact with the undisturbed soil is as a rule in a much worse state of preservation than the uppermost portion; and the same in the main holds good for the present collection.

In our account of these skulls we have given, in addition to photographs, a series of outline tracings of the various aspects taken by means of the dioptograph.[1] So far as it was possible to do so, we have attempted to take tracings of the true normæ, e.g. lateralis, facialis, and verticalis, but, owing to the warping of some of the skulls, this has not been possible and readers, therefore, must not expect to find in every case an exact agreement between the measurements as given by us and the corresponding measurements as indicated on the tracings.

As we pointed out in our previous report,[2] many of these early long-headed skulls are characterized by the great enlargement of that part of the occipital region that lies behind the external auditory meatus. So far as we are aware, the first author to comment on this condition was Keith,[3] who remarked on it in certain Veddah crania. The same condition is present to a very marked degree in certain of the present skulls, and, in order to provide some standard of comparison, we have applied to the external auditory meatus the method that is utilized for determining the position of the bregma. We thus take the total nasion-inion length and, using this as a base line, we then find the distance from the nasion at which a perpendicular line drawn through the centre of the meatus cuts it; from these two measurements we get what we propose to call the "Auditory Meatus Position Index":—

$$\frac{\text{Nasion to foot of meatal perpendicular} \times 100}{\text{Nasion-Inion Line.}}$$

In Tables I–VII detailed lists of all measurements, indices, angles, etc., are given.

Skull No. 1 (Text-Figs. 11, 12, and 13; Pl. CLX, Figs. 1 and 2)

This skull is undoubtedly of recent origin and, to judge from its small size, the general lightness of the bones, the small teeth, the small size of the mastoid processes, and the persistence of certain infantile characters, such as the degree of prominence of the frontal and parietal eminences, must be attributed to the female sex. The cranial sutures are well marked and are moderately complicated; there is no trace of any commencing synostosis anywhere. The age of the individual was in all probability between 20 and 25 years, possibly somewhat nearer the former figure.

Norma facialis (Text-Fig. 11).

The face is moderately long and is rather narrow, the facial index being 87·65 (mesoprosopic). The frontal eminences, as already mentioned, are prominent. The glabella is very slightly raised and the superciliary ridges are weak. A supra-orbital foramen is present on both sides. The orbits are high; the orbital index, which is 91·67, falling in the "hypsiconch" group. The malar bones are of moderate development and are not prominent.

[1] All dioptographic tracings given as text-figures have been reduced by one-half.

[2] Sewell and Guha, loc. cit., p. 60.

[3] Keith, "Report on two human crania of considerable but uncertain antiquity": *Journ. Anthropological Soc. Bombay*, p. 671, 1917, Bombay.

The nose is long and narrow (leptorrhine), the nasal index being 43·75. The bridge of the nose is highly arched and is narrow ; the inter-orbital diameter is 19 mm. The lower margin of the nasal aperture is clean cut and raised in a slight ridge, and the subnasal spine is prominent ; the septum is asymmetrical, being pushed over to the left side.

Norma lateralis (Text-Fig. 12).

The cranium is hypsi-cranial, as is clearly shown by the length-auricular height index, which is 63·82, and the length-height index of 76·64. The glabella, as mentioned, is only slightly marked and there is but very slight depression at the nasion. From the glabella,
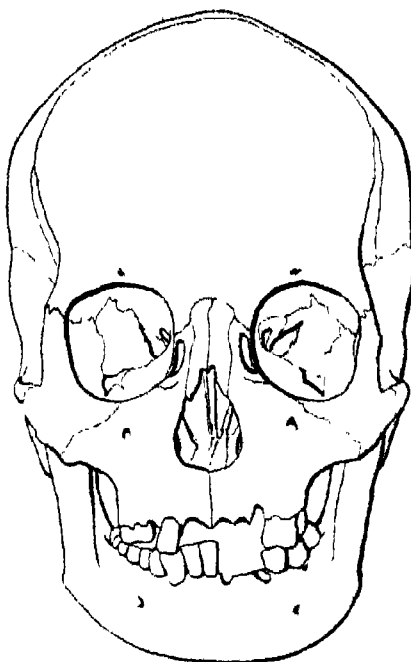
Fig. 11.

the forehead rises nearly vertically and then turns and sweeps backwards in a more or less uniform curve to the inion. The occipital protuberance is well marked. The line of attachment of the temporalis muscle to the frontal bone is well marked and passes upwards and backwards from the external angular process in a nearly straight line at an angle of about 45 degrees ; the continuation of the linea semicircularis across the parietal bone is, however, not marked, and is in places very difficult to trace. Posteriorly above and behind the external auditory meatus the line of attachment of the muscle is raised in a low ridge that can be traced upwards and backwards as far as the squamo-parietal portion of the lambdoid suture. The mastoid process is small but there is a well-marked supra-meatal triangle. The styloid processes were well developed, but that on the right side is broken off. The zygomatic arch is delicate. In the facial part the bridge of the nose is prominent. There is no trace of any subnasal prognathism.
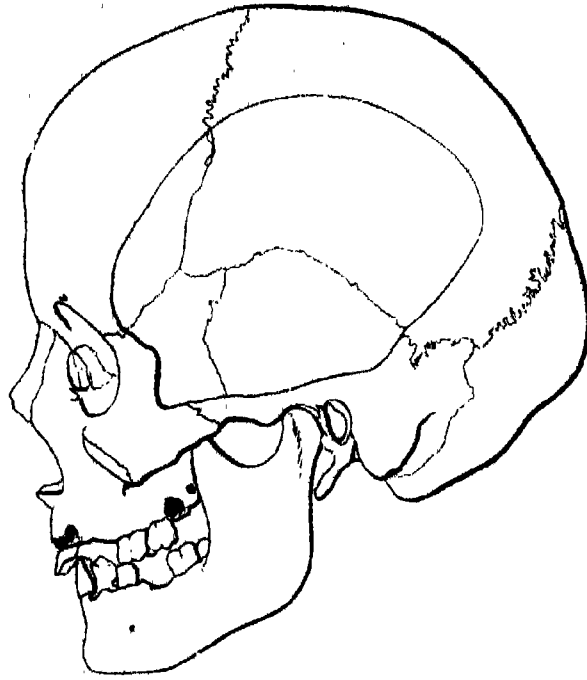
Fig. 12.

Norma verticalis (Text-Fig. 13).

When viewed from above the shape of the skull is seen to correspond to Sergi's "ovoides" type; the frontal and parietal eminences are well marked, the latter particularly so on the
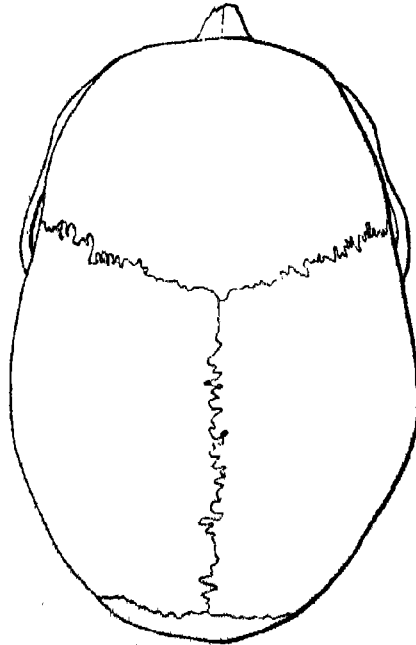
Fig. 13.

right side. The skull is dolichocranial, the length-breadth index being as low as 70·08. In the posterior part of the frontal bone in the middle line, commencing 11 mm. in front of the bregma, is an oval, slightly depressed area, measuring 27 mm. in length by 13 mm. in breadth, the long axis running antero-posteriorly ; this we take to be the scar of an old healed ulcer or wound that has suppurated. A well-marked parietal foramen is present on the left side, and a very minute one on the right. The bregma is situated somewhat far back, the bregma position index being 34·94.

Norma occipitalis.

There is little to record regarding this aspect of the skull. The muscular attachments are only moderately developed. A very small wormian bone is present in the left part of the lambdoid suture at a distance of 26·5 mm. from the lambda.

Norma basilaris.

The foramen magnum is narrow, its index being 81·25. The post-condylar fossa is much more marked on the left side than on the right. The upper jaw is wide, the maxillo-alveolar index being 117·53 (brachyuranic). The palate, as one would expect in a female, is small but broad, the palatal index being 92·31, thus falling within the brachystaphyline series. Unfortunately, most of the teeth of the upper jaw are missing, but those that are present are of moderate size and are only slightly, if at all, worn ; the first molar tooth on the right side shows some slight degree of wear. Both third molars have only recently been erupted.

The Mandible.

The mandible exhibits a moderate degree of development and the chin is moderately prominent. As regards the teeth, the canine and the first molar teeth on the right side are slightly worn, but the third molar is absolutely unworn. It is worth noting that the incisors of the lower jaw appear to have fitted behind the corresponding teeth of the upper jaw, when the mouth was closed, and did not meet edge to edge, as they do in certain of the other skulls and, as Keith[1] has shown, is so often the case in early skulls. Unfortunately, some of the teeth are missing. The lower dental arcade bends slightly outwards at its posterior extremity, so that the distance between the outer surfaces of the third molar teeth is 62 mm. ; the diameter of the dental arcade opposite the second molar teeth is 55 mm., and between the canines it must have been in the neighbourhood of 31 mm., but unfortunately the left canine tooth is missing. The posterior molar teeth are not set vertically in the jaw, but are inclined inwards, so that the biting surfaces slope somewhat downwards and inwards.

Skull No. 2 (Text-Fig. 14)

The whole skull is in a very bad state of preservation, particularly the left side. The whole of the vault is missing, and so also is the greater part of the face. From the thickness of the bones and the general characters of the skull we infer that it belonged to a male.

Norma facialis.

The left maxilla is completely missing and the left malar bone has been thrust inwards and upwards, filling the whole orbital cavity. The right side of the face is also considerably

[1] Keith, Sir Arthur, *The Antiquity of Man*, vol. ii, p. 670, London, 1925.

distorted and flattened, and the maxilla is twisted over to the left. As a result of this deformation it has been absolutely impossible to obtain any measurements, even approximately correct, of the facial part of the skull.

Norma lateralis (Text-Fig. 14).

The skull is clearly orthocranial, the length-auricular height-index being approximately 59·69. On the right side of the skull the greater part is intact, although the malar region has been badly displaced. The zygomatic arch has been fractured in two places, and the malar bone has been pushed inwards and upwards towards the middle line. The outer diploe of the greater part of the cranial bones has been eroded away and the bones themselves are badly cracked, so that it is impossible to detect the sutures in the greater part of their
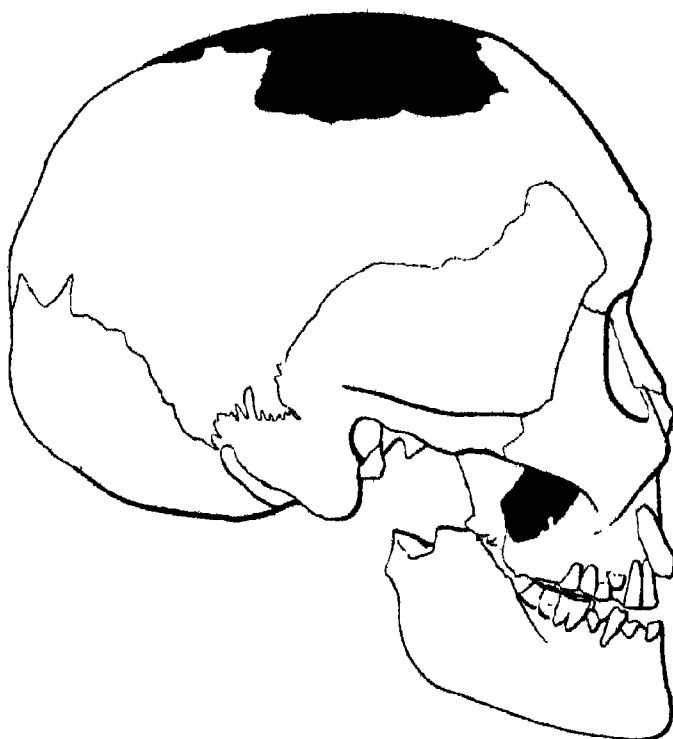
Fig. 14.

course. The region round the nasion is fractured, but it appears to have been depressed. The glabella is prominent and above this point the forehead is retreating. The antero-inferior region of the right parietal bone is fractured and is slightly depressed, and as a result it is not possible to be certain on the point, but it appears that the parietal and alisphenoid met at the pterion. The mastoid process on this side of the skull is intact, and is large and massive; on the left side it is entirely wanting. In the temporo-parietal region of the left side there is a large and depressed fracture; the lower part of the parietal bone and the upper portion of the squamous plate of the temporal bone are broken, and the fractured parts have been driven inwards under the upper and intact portion of the parietal bone; this fractured area measures 85 mm. in length. The depth to which the bone has been driven inwards is much greater in the posterior part of the area, while towards the anterior end the area terminates

in a shallow groove. We hesitate to suggest that this was the cause of death, but the nature of the injury would be compatible with a severe blow from a heavy weapon with a short cutting edge such as an axe.

Norma verticalis.

When viewed from above, it is seen that the skull was certainly dolichocranial in character and probably agreed with Sergi's "ovoides" type. The greater part of the vault is missing, the defect extending from the frontal bone and including the bregma to almost as far back as the lambda. The anterior part of the cranium has also undergone some deformation, the forehead being pushed over towards the left side. The parieto-occipital region of the left side has been somewhat flattened and displaced inwards, so that the occiput appears to be more pointed than in actual life. The bone of the vault was of considerable thickness, and in the region of the back part of the frontal area measures as much as 9·5 mm. in thickness.

Norma occipitalis.

Apart from the distortion mentioned above, there is nothing of interest to note in this aspect of the skull.

Norma basilaris.

As already mentioned, the region of the occipital bone has been damaged and displaced, and the part posterior to the foramen magnum is broken and depressed ; the actual margin of the foramen, however, appears to be intact, and, to judge from the position of the occipital condyles, there has been no deformity in that particular part of the bone. If this view is correct, the foramen magnum is extremely long, the foramen index being in the neighbourhood of 56·4 mm. Both condylar fossæ are well marked, but that on the left side is appreciably bigger than that on the right. The muscular attachments on the basi-occipital bone for the longus capitis and rectus capitis anterior muscles are well marked. The digastric fossæ are also deep. The glenoid fossæ are deep and the tympanic plate is proportionately massive.

The Mandible.

The mandible is strong and well developed. Unfortunately, the bone has been fractured a little to the left of the middle line, the line of fracture extending through the socket of the lateral incisor tooth. The upper part of the right ramus, including both the coronoid and condylar processes, is missing. All the teeth, with the exception of the second and third molars on each side, are missing. The bimolar width of the dental arcade, measured between the second molar teeth, is 57 mm. The teeth are greatly worn, the dentine being freely exposed.

Skull No. 3 (13*b*) (Text-Figs. 15 and 16 ; Pl. CLX, Figs. 3, 4, 5, and 7)

This skull belongs to a male, who was undoubtedly adult, but we are unable to assign any definite age to it. All the teeth have been erupted and some of the sutures give the appearance of having commenced to fuse ; this has certainly taken place in the lower part of the sagittal suture, and part of the lambdoid suture of the left side also appears to have undergone the same process ; but it is impossible to be absolutely certain on this point owing to the fractured condition of the bones. The skull is somewhat distorted and the face is pushed over to the left side. The facial portion is intact, but the posterior region of the skull was

entirely fragmentary and was largely pushed inwards and impacted within the anterior region, while the greater part of the occipital bone is missing, including both the basi- and the ex-occipital regions. Extensive reconstruction of the back part of the skull was thus necessary; and, as a result of this, many of our measurements must be regarded with a considerable degree of caution.

The skull appears to differ essentially from all the other skulls in the present collection. It is large and of a heavy build. From the description that we give below and from the photographs and tracings there can, we think, be little doubt that it is characteristically Mongolian in type; for the purpose of comparison we have given photographs of a typical Nāga skull, No. N. 189, in the collection of the Indian Museum (Pl. CLX, Figs. 6 and 8). The cranium appears to have been nearer the brachycephalic than the dolichocephalic type.
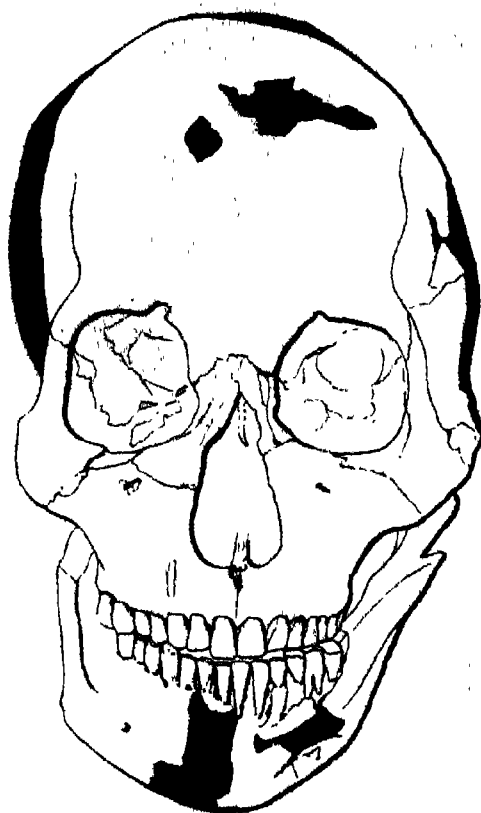
FIG. 15.

Norma facialis (Text-Fig. 15).

The face is moderate in length, the superior facial index being 52·86 (mesene). Owing to the damaged condition of the mandible it is impossible to be certain of the total facial length, but this must have been in the close neighbourhood of 125·8 mm., which would give a total facial index of 89·85 (mesoprosopic). The first thing that strikes one in this view of the skull is the decidedly Mongolian character of the face. The forehead is rounded, the glabella is moderately prominent, and the superciliary ridges are not markedly developed. Keith [1]

[1] Sir Arthur Keith, "Human Skulls from Ancient Cemeteries in the Tarim Basin": *Journ. Royal Anthropol. Institute of Great Britain and Ireland*, vol. lix, p. 149, 1929.

has recently called attention to the characters of the Mongolian forehead and the shape of the external angular process of the frontal bone in this type of skull, and the present example agrees very well, so far as those characters are concerned that Keith regards as characteristic of this racial type. The root of the nose is flat and broad, the interorbital diameter being as high as 23 mm. The orbits are very high ; the orbital index is as great as 97·1 mm., so that the orbital aperture is very nearly square and falls in the hypsiconch group. The nose is moderately long, the nasal index being 49·1 mm., thus falling within the limits of the mesorrhine group. There is a well-marked subnasal gutter present on each side.
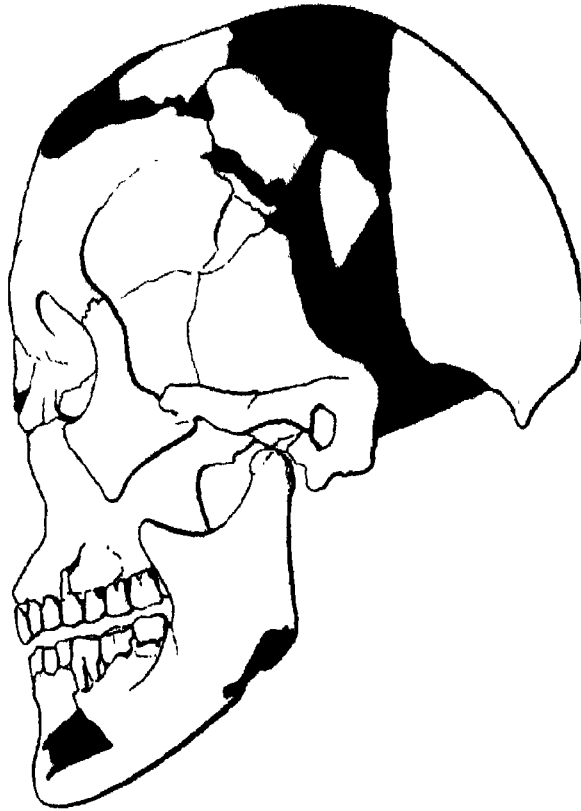
Fig. 16.

Norma lateralis (Text-Fig. 16).

The external auditory meatus and the zygomatic arch are absent on the right side of the skull. On the left side the alisphenoid and the parietal meet at the pterion ; the fronto-parietal suture has already closed. In the same paper Keith[1] has devised a new method of estimating the degree of projection of the various features of the face, such as the glabella, the root of the nose, the cheekbones, chin, etc., and he has shown that in the Mongolian skull the outer margin of the orbit is more advanced and is further from the centre of the external auditory meatus than in the European skull. Such a forward projection of the cheeks is well marked in this skull ; the malar bones are very prominent and this gives a characteristic

[1] Sir Arthur Keith, loc. cit., p. 169.

flat appearance to the face as a whole. As well as being prominent, the malar bones are of stout build, the orbitale-zygomaxillare distance being as high as 32 mm. The nasion was not depressed and the nose was certainly not prominent; unfortunately, the lower portions of both nasal bones are missing, so that it is impossible to determine the exact degree of projection, but, as mentioned above, the root of the nose is flat and broad. There is a considerable degree of subnasal prognathism, but the face as a whole is mesognathic.

Norma basilaris.

The most striking feature in this aspect of the skull is the great width of the palate and the dental arcade. The palatal index is as high as 95·92 mm. and this is not due in any way, so far as we can judge, to posthumous deformity or warping, for the facial portion of the skull is very well preserved. So high an index as this merits the creation of a special class, which may be termed "hyperbrachystaphyline". The maxillo-alveolar index is equally high, being 138·49, and is therefore "hyperbrachyuranic". The dental arcade is almost parabolic in its curvature, the width between the molar teeth steadily increasing from before backwards; the bicanine width is 41 mm. and bimolar width, measured between the outer surfaces of the second molar teeth, is as high as 71 mm.

The Mandible.

The mandible is powerfully built, but has undergone a considerable degree of warping and damage. The greater portion of the right ascending ramus, including both the coronoid and condylar processes, is missing, and the right angle is also absent. Unfortunately, the median portion of the jaw between the incisor teeth was badly damaged and considerable reconstruction was necessary. The bicanine diameter of the reconstructed jaw is 37·5 mm., and the bimolar diameter between the second molar teeth is 67·2, while between the outer surfaces of the third molar teeth the diameter is 70·3 mm. All the teeth are badly worn, the dentine being freely exposed. The depth of the body of the mandible cannot be accurately measured between the incisor teeth, owing to the damage to the front part of the jaw, but it must have been approximately 34·7 mm. The depth of the body in front of the second molar tooth is 36·1 mm.; of this there can be no doubt, as this portion of the jaw is well preserved.

Skull No. 6 (Text-Figs. 17 and 18; Pls. CLX and CLXI, Figs. 9 and 10)

This skull is extremely long and appears to have been that of a male. Judging from the fact that all the teeth have been erupted and that none of the sutures have commenced to show any signs of synostosis, there can be no doubt that the individual was in the prime of life at the time of his death.

Norma facialis (Text-Fig. 17).

The glabella and superciliary ridges are not pronounced, and the forehead is rounded. The orbits appear to have been rather low, but the supra-orbital margin of the left side has been fractured and the upper and outer portion has been displaced downwards, thus making the orbit appear rather lower and the vertical diameter less than it was in life; the whole of the outer and lower margin of the right orbit is missing. The nose is of moderate length

(mesorrhine) and the subnasal margin is clear cut, without any rounding off of the edge or trace of guttering. The distance from the subnasal spine to the alveolar margin is long, 22 mm.

Norma lateralis (Text-Fig. 18).

When viewed from the side it is seen that the forehead rises almost vertically from the nasion. The glabella is only slightly marked and the superciliary ridges are not prominent. The line of the vault of the cranium passes upwards and backwards along the vertex and then downwards to the inion in an almost smooth and uniform curve, that is strikingly similar
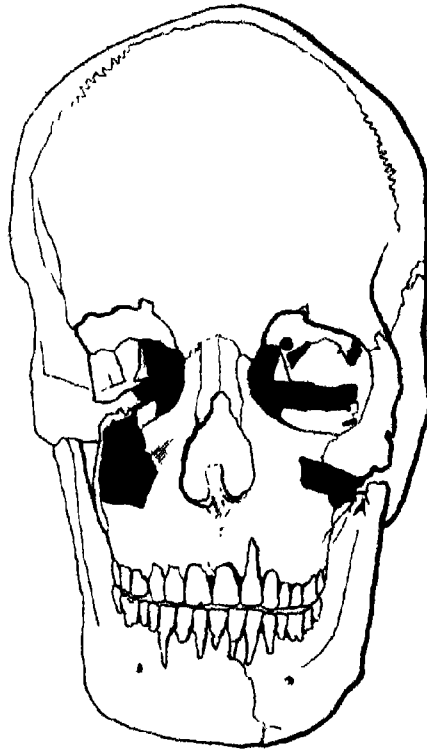
Fig. 17.

to the curvature of the vault in the same view of the "Nāl" skull.[1] The alisphenoids, as is usual, come into contact with the anterior inferior angles of the parietal bones on both sides of the skull. The mastoid process is fairly massive and is not unusually prominent. Both zygomatic arches are missing and, in addition, the right malar bone is also absent. The bridge of the nose is moderately high, and there is some degree of subnasal prognathism.

On the right side of the skull, extending from the lambda, or slightly beyond the lambda on the left side, passing across the sagittal suture and then extending forwards in a straight line across the right parietal bone and into the alisphenoid, is a straight cut that measures 146 mm. in length ; above this cut the right parietal bone is intact, but below the cut the lower

[1] *Vide* Sewell and Guha, loc. cit., pl. xxiv, fig. 2.

part of the parietal bone and approximately the upper third of the squamous plate of the temporal bone is missing. We are of the opinion that a cut such as this, that has bitten through the parietal bone without producing any marked fracturing of the portion of the bone that remains, could only have been done during life with a sharp and heavy weapon, such as a sword, and that this was in all probability the cause of death.

Norma verticalis.

When viewed from above the general outline of the skull clearly resembles that of Sergi's "ovoides" type. The frontal eminences are not marked and the parietal eminences are only moderately developed. There has been a certain degree of distortion. The left parietal region has been somewhat distorted and displaced, the result being that the two parietal bones in the region of the sagittal suture have been forced slightly outwards (upwards). The occipital region has also been forced out and slightly to the left.
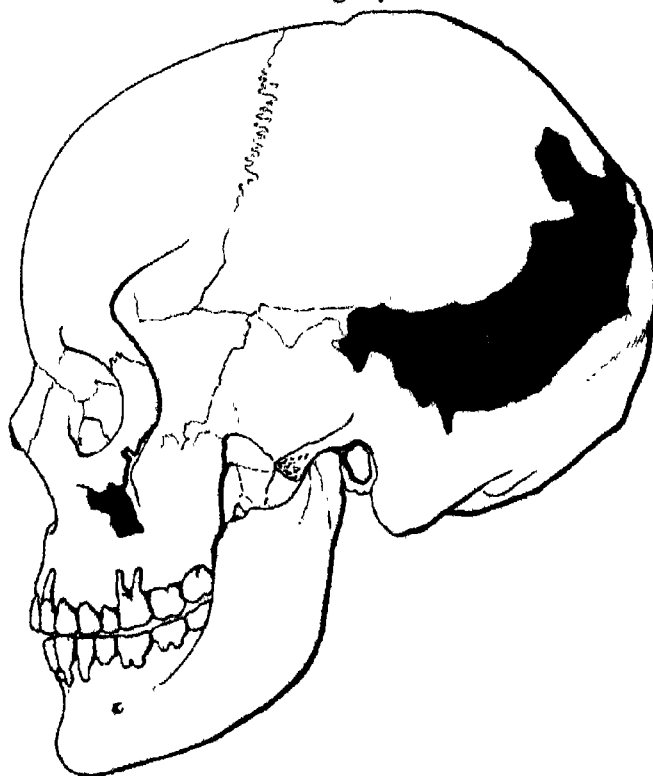
FIG. 18.

Norma basilaris.

The distortion of the occiput appears to be much more marked in this view of the skull. The post-condyloid fossa is more developed on the left side than on the right. The ridges of the muscular attachments to the occiput are well developed, but the digastric fossa is shallow. The tympanic plate is comparatively stout and thick; the styloid processes are missing on both sides. The glenoid fossæ are deep. The teeth are all considerably worn, and the wear of the incisor teeth shows that during life they were in apposition with the teeth of the lower jaw, the bite being "edge to edge". There is a small patch of caries in the third molar tooth on the right side. The palate is high and there is a low torus. The upper dental arcade possesses a bicanine diameter of 38·5 mm. and a bimolar diameter between the second molar teeth of 65·5 mm. The molar length is 43 mm.

The Mandible.

The mandible is powerful and the teeth are large. In the lower dental arcade, the bicanine diameter is 35·5 mm. and the bimolar diameter is 59·5 mm. The median length of the dental arcade is 53 mm. The chin is moderately prominent.

Skull No. 7 (Text-Figs. 19, 20, and 21 ; Pl. CLXI, Fig. 11)

The skull is a small one and appears to have belonged to a female ; the bones are very light, the glabella and superciliary ridges are only slightly developed. The skull has undergone a considerable degree of distortion and damage. The facial part of the skull has been pushed over towards the right side, while the occipital area has also undergone considerable displacement towards the same side; thus the sagittal line of the skull follows a curve. The right parietal region has been forced outwards and upwards, and there is a long and slightly S-shaped fracture dividing the posterior half of the right parietal bone into two almost equal
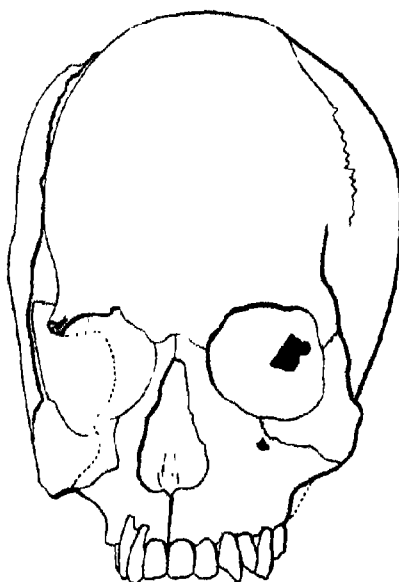
Fig. 19.

parts. The anterior half of the bone is broken and a considerable portion is missing ; the temporosphenoidal region of the same side is depressed, and the squamous plate is broken into two parts by a vertical fracture. On the basal aspect of the skull, the right part of the occipital bone has been pushed inwards towards the middle line, and this has entirely destroyed the integrity of the foramen magnum.

Norma facialis (Text-Fig. 19).

The orbits are moderately high, the orbital index being 82·7 mm. ; thus, the orbit falls within the limits of the mesoconch group. The nose is narrow at the root, the interorbital diameter being only 18·5 mm. ; it is of moderate length (mesorrhine), the nasal index being 50·8 mm. There are no traces of any subnasal gutter, the inferior margins of the nasal cavities being clean cut and sharp. The distance between the lower margin of the nose and the alveolar margin is small, measuring only 15·0 mm. The malar bones are not markedly prominent.

Norma lateralis (Text-Fig. 20)

The glabella is only slightly marked, and the nasion is not depressed. The forehead rises with only a slight backward inclination and then turns into the general outline of the vault, which is very similar to that of the "Nāl" skull, being highly arched. The parietals and alisphenoids meet at the pterion. The frontal eminences are not marked nor, as mentioned above, are the superciliary ridges. None of the sutures appear to have undergone any synostosis, and the third molar teeth are only just cut, and have not yet fully developed, so that the age of the individual must have been about 20 to 25 years. The occipital region is extremely long and well-developed, and, as a result, the position of the external auditory
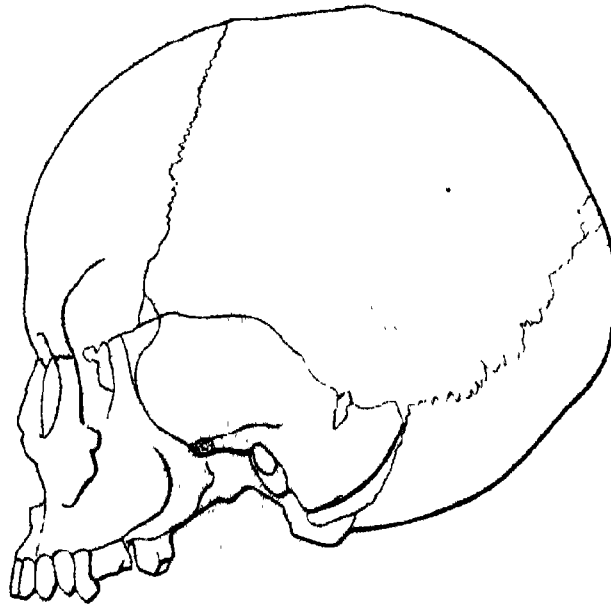
Fig. 20.

meatus lies very far forward; the meatus position index is thus 40·69. The mastoid process is small and the digastric fossæ are not very deep. The tympanic plate shows a degree of moderate development. Unfortunately, the distal ends of both nasal bones are missing, so that it is impossible to draw any definite conclusions regarding the degree of prominence of the nose during life, but it does not appear to have been high. The malar bones are small and the zygomatic arches are missing on both sides, but the root of the process is small and delicate. The distance between the orbitale and the zygomaxillare on the left side is 28·5 mm., which is greater than one would expect from the general appearance of the skull; this increased distance is due to the prolongation of the malar process of the maxilla outwards, the actual depth of the malar bone itself being only 21·0 mm. There is some degree of sub-nasal prognathism.

Norma verticalis (Text-Fig. 21).

When viewed from above, it is clearly seen that the skull was very long, though the warping and damage prevent one from forming any definite opinion regarding the cephalic index or the character of the general outline. The forehead is rounded and the frontal eminences are only slightly marked. The left parietal eminence is well developed, but that on the right side has been distorted and nearly obliterated by damage to the bones.

Norma occipitalis.

There is but little to record regarding this aspect of the skull. The lateral walls of the cranium appear to have bulged slightly outwards, as they rose from the mastoid processes.
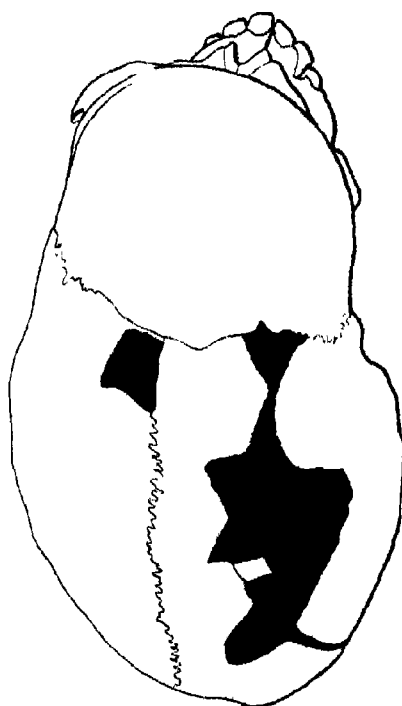
Fig. 21.

Norma basilaris.

The palate is somewhat crushed but appears to have been very narrow with a high vault. The teeth are well developed and are very little worn. The third molar tooth does not appear to have erupted on either side, but owing to damage it is not possible to be certain on this point. As regards the dental arcade, owing to the crushed condition of the palate and the skull in general any measurements must be regarded with a considerable degree of caution. The bicanine diameter is 39·5 mm., and the diameter between the outer surfaces of the first molar teeth is 54 mm.; between the surfaces of the second molar teeth it is, however, only 46·5 mm., but this diameter must have been greater during life. The incisor teeth are shovel-shaped. The muscular attachments to the occipital bone are not very well developed and the digastric fossa is small.

Skull No. 8 (Text-Figs. 22 and 23 ; Pl. CLXI, Figs. 12, 13)

This skull has undergone considerable warping and damage. The face has been pushed over to the right side, the right zygomatic arch has been broken, and the greater part of it is missing. The left orbit has been greatly distorted. The frontal region near the upper and inner angle of the left orbit has been forced outwards and the glabella has also been driven outwards. The nasal bones are separated from the frontal and maxillary bones and driven inwards. The posterior region of the skull has been badly broken ; the posterior part of the right parietal bone and the supra occipital part of the occipital bone have been badly fractured, the left side of the occipital region and the posterior part of the left parietal bone is fragmented, and the greater part of the temporal bone, including the mastoid, is absent. From this it will be clear that it is not possible to arrive at any very definite conclusion regarding the racial affinities of the individual to whom it belonged.
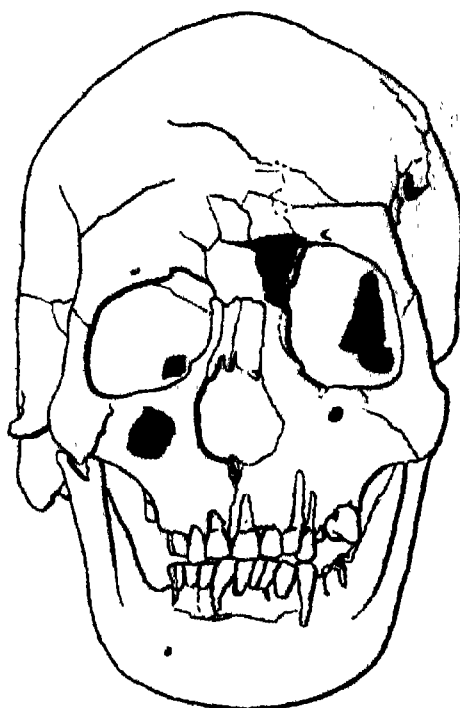
Fig. 22.

Norma facialis (Text-Fig. 22).

The forehead appears to have been rounded and the minimum frontal diameter is of moderate length. The glabella and superciliary ridges are not prominent. The left orbit is greatly distorted, but the right is more or less intact and appears to have been low. The interorbital diameter is wide. There is a supra-orbital notch on the right side, but on the left there is a foramen. The malar bones are of moderate size and are not prominent. The nose is very broad ; the nasal index is 58 mm., which places the skull in the chamærrhine group. The lower margin of the nose does not show any trace of a nasal gutter, the margin being clean cut. Immediately below the nose the subnasal region of the maxilla is depressed and flattened, and at the outer margin of this flattened area the root of the canine tooth raises a very distinct ridge.

Norma lateralis (Text-Fig. 23).

Owing to the damaged condition of the frontal region it is difficult to determine the characters of the forehead ; it appears to have risen almost vertically from the glabella. The vertex is of moderate height and was slightly flattened. The post-auricular region of the skull is very distinctly shorter than in the majority of the skulls. The malar bone is, as mentioned already, of moderate development, the depth of the bone being 21 mm., while the distance from the orbitale to the zygo maxillare is 27 mm. The nose has a moderately high arch. The face is prognathic, due in the main to the subnasal prognathic projection of the maxilla. There is also some degree of alveolar prognathism present.
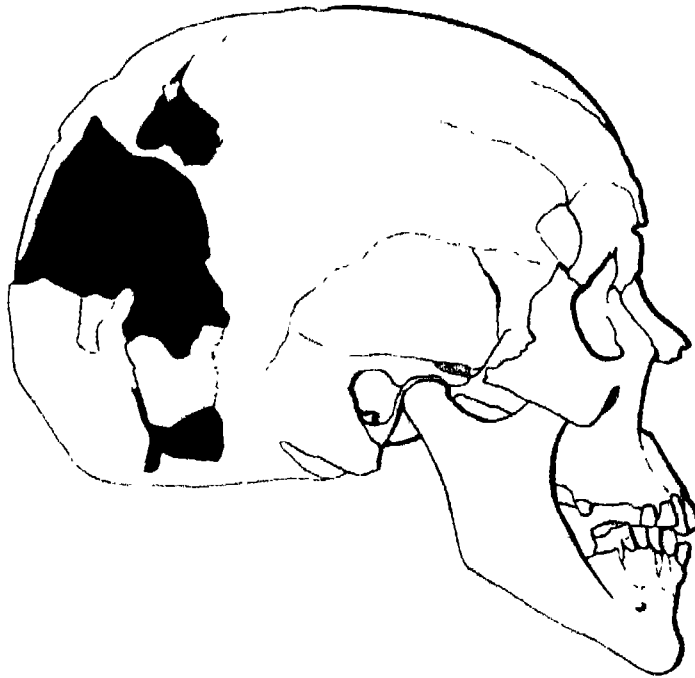
Fig. 23.

Norma verticalis.

When viewed from this aspect it is clear that the skull had a distinct tendency towards brachycephaly, but it is not possible to arrive at an exact estimate of the maximum diameter during life, owing to the damaged condition of the parietal region.

Norma occipitalis.

The sides of the skull rise nearly vertically from the mastoids.

Norma basilaris.

The left half of the foramen magnum is missing. The mascular attachments to the post-occipital area are not marked. The digastric fossæ are of moderate size. The bimastoid diameter appears to have been high ; as only one-half of the skull is intact, it is impossible to measure the diameter exactly, but, calculating from one-half, the total diameter seems to have

been in the neighbourhood of 160 mm. The palate is U-shaped, the diameter being 38 mm. and the palatal height 11 mm. In the upper dental arcade the bicanine diameter is 31 mm. It is impossible to measure the bimolar diameter, as the first and third molar teeth are missing on the right side and all trace of the root sockets has been absorbed in the case of both teeth. On the left side the second premolar and all the molar teeth are absent. The biting surfaces of such teeth as are left are remarkably worn.

The Mandible.

The mandible has undergone considerable warping and the posterior teeth are missing. All the teeth that remain are markedly worn. The chin is moderately well developed. The bone as a whole is of moderate build and, to judge from the condition of those teeth that remain, the bite must have been " edge to edge ".

Skull No. 10 (Text-Fig. 24)

This skull is comparatively small and the component bones are thin and delicate ; the muscular ridges are not well marked and in all probability the individual was a female. The skull, as is shown by the photographs taken at the time of excavation, lay on its right side, and it is interesting to note that, contrary to the usual rule, it is the left side of the skull, which lay uppermost, that has suffered the greater amount of damage. The left side of the cranium and the greater part of the left side of the face are missing. There has also been a considerable degree of distortion ; the frontal and right parietal bones have been forced apart, and the bones in the region of the right parieto-temporal suture have been forced inwards. An extensive fracture runs across the occipital region in a horizontal direction, and the two parts of the bone have been forced apart to the extent of about one-half of an inch. All the teeth have been erupted, and there is no sign of any synostosis of the sutures ; the individual, therefore, must have been adult and in the prime of life.

Norma facialis.

The forehead is rounded and the frontal eminences are not well marked. The malar bones do not appear to have been prominent. The orbit is high, the orbital index being 86·06 mm., which puts it in the hypsiconch group. The nasal region is fractured and the greater part of the left maxilla, as well as the whole of the left malar bone, is absent ; fortunately, the ascending ramus of the left maxilla is present, and we are thus able to reach some conclusion regarding the character of the nose. The bridge of the nose is moderately prominent and the root is narrow, the interorbital breadth being only 21·5 mm. The nose is moderately narrow, the nasal index being 47·8 mm., so that it just falls outside the limits of the leptorrhine group.

Norma lateralis (Text-Fig. 24).

There is little or no depression at the root of the nose, and the glabella is only very slightly marked. The superciliary ridges are inconspicuous. The forehead is slightly retreating and passes upwards and backwards into the general contour of the vertex in a uniform curve. The outline of the vertex presents a smooth, high curve that is in close agreement with the condition that we found in the " Nāl " cranium (*vide* Sewell and Guha, loc. cit., pl. xxiv). It is not possible to be absolutely certain that this high arch of the vault is not due, at any rate in part, to the distortion and compression that the skull has undergone, but we are of the opinion

that it was probably present in life. On the right side the parietal bone meets the alisphenoid at the pterion, but on the left the less usual arrangement of the frontal bone meeting the squamous plate of the temporal bone seems to have been present. The posterior region of the skull and especially of the occipital region is not so markedly developed as in certain other skulls in the collection and, as a result, the external auditory meatus is nearer the posterior aspect; this is clearly indicated by the auditory meatus position index, that is 58·33. The mastoid process is not markedly prominent, but the digastric fossa is deep. The tympanic plate is thin in comparison with certain other skulls, especially Nos. 2, 11, and M. The right zygomatic arch is broken. The malar bone is small, the distance between the orbitale and the zygomaxillare being only 24 mm. The bridge of the nose is moderately prominent.
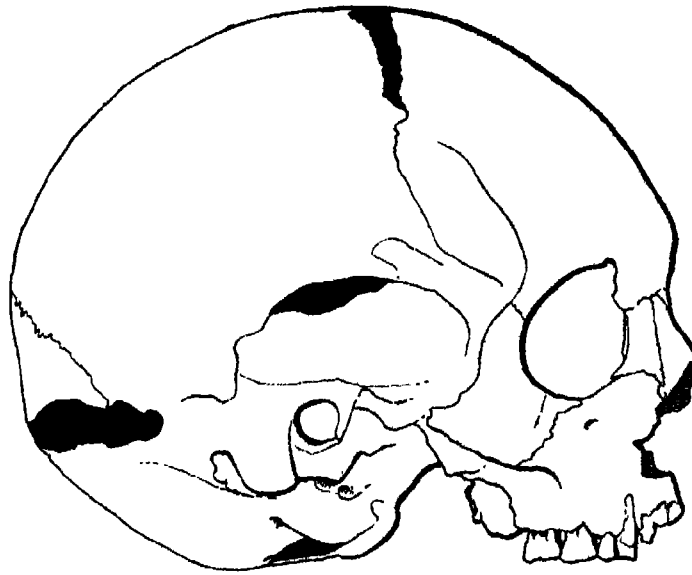
FIG. 24.

Norma occipitalis.

There is a vertical cut on the posterior aspect of the skull at a distance of half-an-inch to the right of the sagittal suture and extending from a point 67 mm. in front of the lambda into the supraoccipital region. The bone to the left of the cut, including such parts of the left parietal and supraoccipital bones as are left, is depressed. There is a transverse fracture across the occipital bone extending to the right asterion.

Norma basilaris.

The foramen magnum is long. The right postcondylar fossa is much deeper than the left. As mentioned already, the digastric fossa is deep and the glenoid fossae are also moderately deep. The palate appears to have been moderately wide; its depth is 13·5 mm. The teeth are mostly absent, but those that are present are much worn.

Skull No. 11 (Text-Figs. 25, 26, and 27; Pl. CLXI, Figs. 14 and 15)

This skull appears to be that of a male in the prime of life. The skull is a large one and the bones are thick and heavy. On the right side most of the parietal bone and the squamous plate of the temporal bone is missing. While possessing a long head that agrees in its general shape and configuration with certain other long-headed skulls in the collection, the general characters of the face, especially the great development of the glabella and the superciliary ridges, the depressed root of the nose and the great width of the interorbital diameter, as well as the not very marked projection of the nose itself, all point to this individual belonging, not to the Mediterranean race, but to the Proto-Australoids.
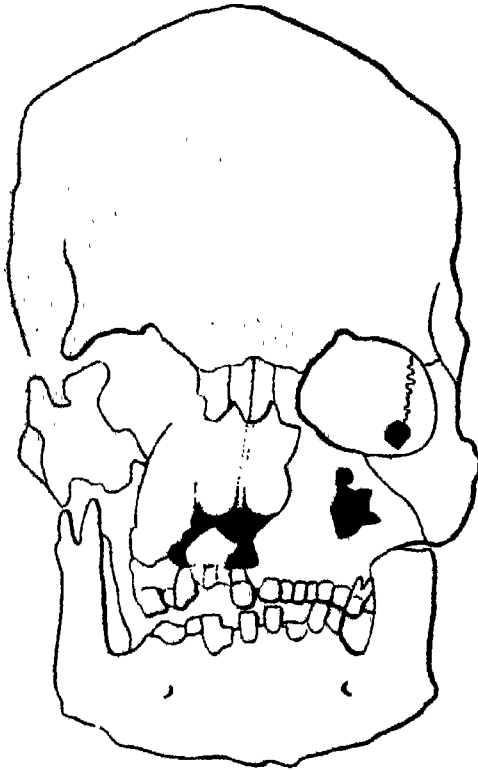
Fig. 25.

Norma facialis (Text-Fig. 25).

The right malar bone and part of the right maxilla are missing. The forehead is low and somewhat retreating. The superciliary ridges are marked, meeting at the glabella, which is itself markedly developed. The root of the nose is wide and depressed. The orbits are not high; the orbital index is 84·46, which puts it in the mesoconch group. The supra-orbital notches are large. The malar bone is strongly developed and projects markedly laterally, so that the face must have been broad in life. The nose is wide, the nasal index being 51·06 (chamærrhine). There is no trace of any subnasal gutter, the lower margin of the pyriform aperture being sharply marked and crest-like. The mandible is heavily built and is wide, the angles are everted, and the bigonial breadth is 105 mm.

Norma lateralis (Text-Fig. 26).

Commencing at the nasion, this, as we have noted above, is depressed, while on the other hand the glabella is remarkably prominent and the superciliary ridges well marked. The forehead is receding, but the general outline of the vault of the skull passes back in a low but uniform curve to the inion, which is very prominent. On the right side of the skull, the lateral part of the cranium is missing, while on the left side it is depressed and fractured; we are, therefore, unable to give an exact reading of the maximum width. On the left side the antero-inferior angle of the parietal bone meets the alisphenoid; on the right side the arrangement of the sutures cannot be determined owing to the extensive fracturing of the bones. The mastoid process is long, though not very massive. The tympanic plate is massive and thick. The zygomatic arch on the left side is strong and
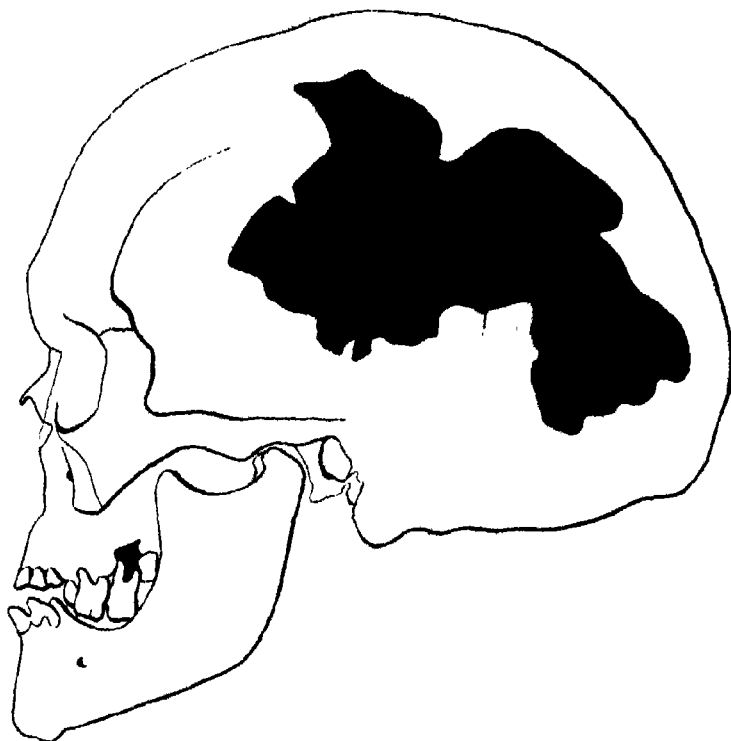
Fig. 26.

not markedly curved, but it must be borne in mind that this may be due to post-mortem flattening as the result of pressure. The attachment of the masseter muscle to the lower surface of the arch and the malar bone is remarkably well developed. The malar bone is strongly developed, and is very deep, measuring 30 mm. between the orbitale and the zygomaxillare, whereas in a normal modern skull this measurement falls in the neighbourhood of 25 mm. The nose is moderately prominent. Unfortunately, both the ascending ramus of the maxilla and the nasal bones are somewhat damaged, so that it is impossible to measure exactly the degree of protrusion of the nose, according to Keiths' method.[1] The subnasal spine is also damaged. There is some degree of subnasal prognathism. The incisor teeth clearly met " edge to edge ".

[1] Sir Arthur Keith, "Human Skulls from ancient Cemeteries in the Tarim Basin": *JRAI.* vol. lix, p. 149 (1929).

Norma verticalis (Text-Fig. 27).

The skull is extremely long and was probably narrow, but as both sides are damaged, it is impossible to give the exact measurement; the cranial index, as estimated by us, is approximately 68·72 (hyperdolichocranial). The sagittal suture is closed, except at the anterior end, and so also is the lambdoid.

Norma occipitalis.

The inion is very well marked and the superior nuchal lines are raised into definite ridges. There is a distinct tendency to scaphocephaly in the posterior part of the parietal region.
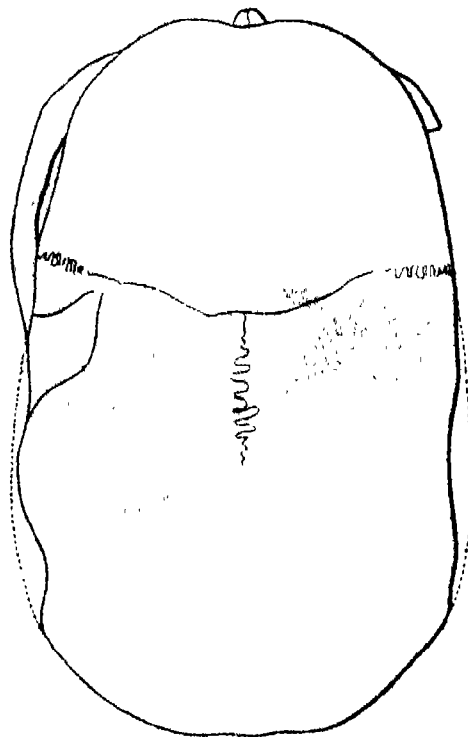
Fig. 27.

Norma basilaris.

The foramen magnum is long, the foramen index being 77·61 mm. The muscular attachments of the occipital bone are all well marked and the digastric fossa is very wide and deep. The postcondylar fossa is larger on the left side than on the right. The tympanic plate is thick and well developed, and the glenoid fossa is deep. The palate appears to have been somewhat on the small side for a skull that is, in other respects, so well developed; but apart from this its proportions are normal; it is comparatively high, the height being 15 mm. Unfortunately, some of the teeth are missing, so that it is not possible to determine exactly the dimensions of the dental arcade. The bicanine width must have been in the neighbourhood of 38 mm. and the bimolar diameter is 62·5 mm. The length of the dental

arcade is 51 mm. All the teeth are much worn, especially the incisors, and it is clear that the bite was "edge to edge". There has been considerable exfoliation of the molar teeth owing to the absence of the corresponding molars in the lower jaw.

The Mandible.

The mandible is large and massive and extremely broad, the bigonial diameter being 105 mm.; the angles are everted. The chin is not prominent. All three molar teeth on the left side and the second and third on the right are absent, and all trace of the teeth sockets has been obliterated. As in the case of the upper jaw, the teeth are all extremely worn.

Skull No. 14 (Text-Figs. 28, 29, and 30; Pl. CLXI, Figs. 16, 17, and 18)

This skull belongs to a child, aged between 9 and 10 years. The canines, first premolars, and the second and third molars of the permanent dentition have not yet been erupted. The
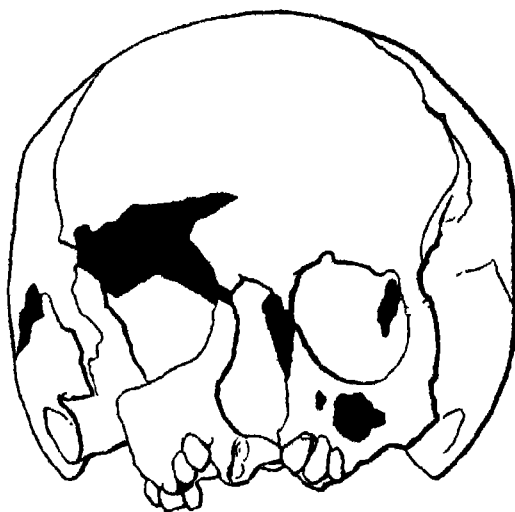
Fig. 28.

skull is naturally small and the bones thin and light. The head was markedly brachycranial. The outer part of the right orbit and the whole of the right zygomatic arch are missing, while the left zygomatic arch is also broken and absent.

Norma facialis (Text-Fig. 28).

Unfortunately, the facial part of the skull has been badly damaged. The forehead is rounded and slightly bulging, as one would expect in a child. There is no glabella, nor are the superciliary ridges developed. The orbit is high, the index being 89·85 mm. (hypsiconch). The nose appears to have been moderately long and narrow, but we are unable to give any measurements.

Norma lateralis (Text-Fig. 29).

The glabella is not marked, and there is no depression at the root of the nose. The forehead rises vertically upwards and then slightly recedes. The highest part of the vertex appears to lie in front of the bregma; from this point the vault of the skull slopes slightly

downwards until a point is reached about the middle of the parietal bones, i.e., the middle of the sagittal suture, where the line of the vault bends somewhat sharply downwards to the occipital protuberance. The part of the skull between these two latter points, i.e., the middle of the sagittal suture and the inion, is remarkably flattened. It is probable that this flattening is posthumous, since the skull was lying on the occipito-parietal region, with the face upwards. The left parietal bone and the neighbouring part of the frontal bone are badly cracked, the bones in the region of the pterion are fractured and somewhat depressed. Near the left asterion the lamboid suture has opened up, the bones having been forced apart. A small wormian bone, measuring 14 mm. by 14 mm., lies near the left asterion. The mastoid process, as one would expect in a child, is small, but the digastric fossa is well marked on both sides. Unfortunately, both the nasal bones and the front parts of the maxillæ, lying below the pyriform aperture, are absent.
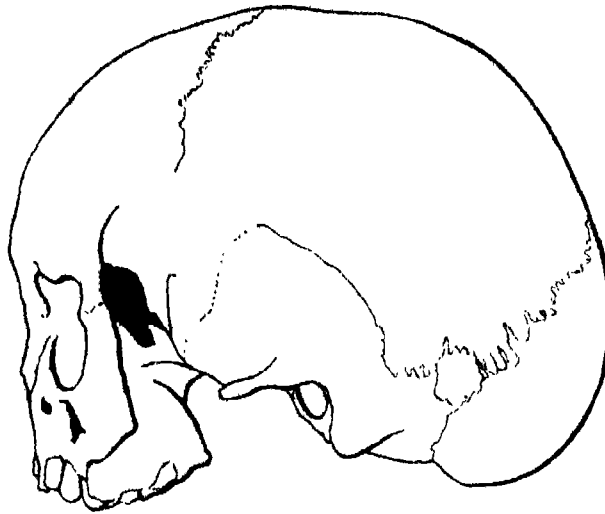
Fig. 29.

Norma verticalis (Text-Fig. 30).

The forehead is rounded. The frontal eminences are not particularly marked, but on the other hand, the parietal eminences are particularly prominent. A parietal foramen is present on both sides.

Norma occipitalis.

Two cracks start from the region of the lambda ; on the left side the fissure crosses the left parietal bone till it reaches the pterion ; on the right side the fissure passes downwards and then outwards and forwards to a point about an inch in front of the parietal eminence. In the supraoccipital region a large part of the bone is missing, measuring about 50 mm. by 15 mm.

Norma basilaris.

The foramen magnum is round, the foramen index being 82·35. On either side of the foramen, the areas of the occipital condyles are low and ill-defined, and they present a pitted surface that closely resembles that found between a diaphysis and an epiphysis; presumably this effect is due to incomplete ossification of the condylar region. The right post-condylar fossa is smaller in extent than that of the left side, but is much deeper. The mastoids are small, but the bimastoid diameter is large, measuring 104 mm. The palate is wide but shallow.
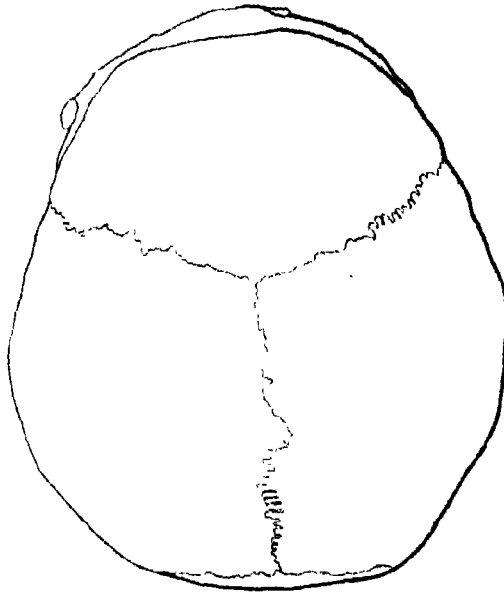
FIG. 30.

Skull No. 19 (Text-Figs. 31, 32, and 33; Pl. CLXI, Figs. 19, 20, and 21)

The age of this individual lies between 18 and 23 years, and is probably nearer the former figure. The skull appears to have belonged to a female, for it is small and the bones are light, the muscular ridges are not marked, and the lower jaw is small and delicate. The face is narrow. There is no trace of any synostosis in the sutures.

Norma facialis (Text-Fig. 31).

The face is small and narrow. The forehead is rounded and the glabella and the superciliary ridges are only slightly marked. There is a supraorbital foramen present on the left side and the usual notch on the right. The frontal eminences are not marked. The nose is narrow, the nasal index being 44·68 mm., which puts it in the hyper-leptorrhine group. The bridge of the nose is also narrow and is moderately arched. The orbits are hypsiconch, the orbital index being 86·39. The malar bones are small and are not prominent.
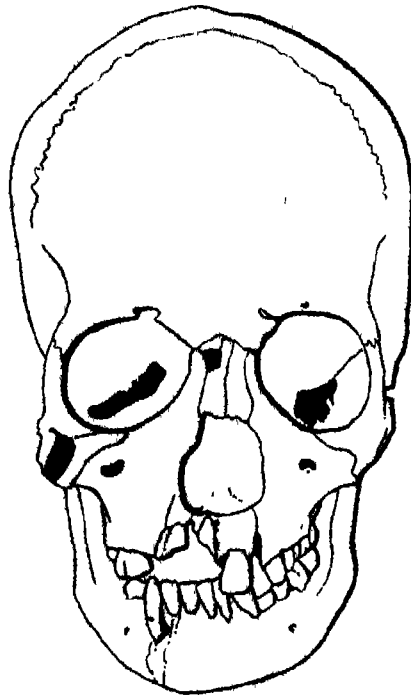
Fig. 31.

Norma lateralis (Text-Fig. 32).

Viewed from the side, the skull appears to be very long and narrow. The forehead rises almost vertically from the nasion. The vertex is not highly arched, as in the " Nāl "
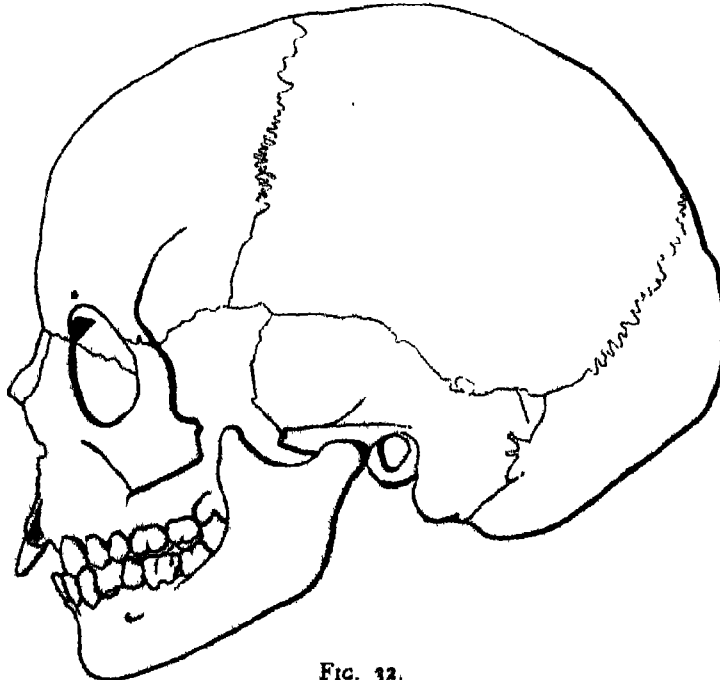
Fig. 32.

type, but, on the contrary, the top of the vault is rather flat. The frontal and parietal eminences are not marked. The occipital region appears to be extremely long, but this is in large part

due to the crushing that the skull has undergone. The mastoid is small ; the malar bones are small and the zygomatic arches are delicate. The parietal and alisphenoid bones meet at the pterion. The nasion is not depressed and the bridge of the nose is moderately arched. A considerable degree of both subnasal and alveolar prognathism is present, so that the upper incisor teeth project forwards to a marked degree ; the face, as a whole, is mesognathic.

Norma verticalis. (Text-Fig. 33).

The skull is badly crushed from side to side, especially in the parieto-occipital region. The right parietal bone is broken at the antero-inferior angle, and the anterior part of the bone has been depressed and pushed inwards below the level of the frontal bone. The thickness
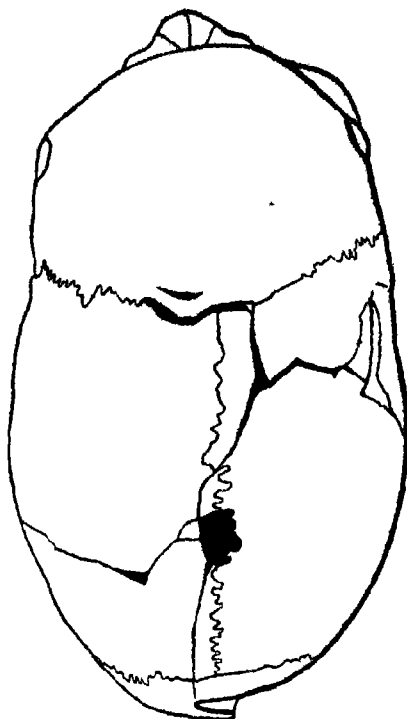
Fig. 33.

of the parietal bone in this area is only 3·5 mm. So far as it is possible to judge, the outline of this aspect of the skull during life was an elongate oval ; but, as a result of the compression, the bones are badly fractured ; there is a Y-shaped fracture in the region of the lambda and the upper stem of the Y passes upwards and to the left about half-an-inch to the left of the lambda, and this continues on over the vertex parallel to the sagittal suture to about the junction of its anterior and middle thirds, where it crosses the suture and then divides into two, one limb running straight to the bregma, while the other passes to the right across the anterior part of the right parietal bone.

Norma occipitalis.

Owing to the lateral compression of the skull, the region of the inion has been forced outwards. The thickness of the skull wall in this region is 5·0 mm.

Norma basilaris.

The basis cranii is badly compressed, so that the two occipital condyles almost touch one another, the foramen magnum being completely obliterated ; the basi-occipital bone has been forced downwards and to the left. The muscular attachments to the occipital bone are not marked, and the digastric fossa is remarkably shallow. The tympanic plate is moderately stout ; both styloid processes are broken. The palate is long and narrow, but this may be due, at least in part, to the lateral compression ; the palatal index, as calculated by us, is leptostaphyline. The teeth are of moderate size and the dental arcade does not present any unusual features. The teeth are hardly at all worn and the last molar tooth has not been erupted. The bicanine diameter is 39·5 mm. and the bimolar measurement is 55·5 mm.

The Mandible.

The mandible, as already mentioned, is small and delicate. There is only a slight degree of prominence of the chin. In the lower dental arcade the bicanine measurement is 30·5 mm.

Fig. 34.

and the bimolar diameter is 54·0 mm. The lower incisors are small and are irregular ; it is clear that during life they did not meet the teeth of the upper jaw in an "edge to edge" bite, but fitted behind them.

Skull No. 20 (Text-Fig. 34)

The whole of the left side of the skull, excepting the mastoid and the frontal region, is absent. The upper portion of the frontal bone on the left side, the whole of the left parietal, and most of the supra-occipital regions are missing. On the right side the greater portion of the parietal is missing and there is a large V-shaped interval, one limb of which extends between the frontal bone and the remains of the right parietal, while the other limb passes upwards and forwards into the frontal region ; and the right half of the frontal bone has lost the outer diploe. The root of the zygomatic arch is extraordinarily stout and heavily built. The mastoid process is long and massive ; the digastric fossæ are comparatively small, but the glenoid fossa is moderately deep. The muscular attachments to the occipital bone are well marked. The forehead is rounded and the superciliary ridges moderately well marked.

The Face.

The bridge of the nose is very narrow and moderately prominent. The root of the nose and the upper part of the left maxilla were attached to each other, but separated from the cranium. Both the molar bones are absent.

The maxillary region was entirely separate and in two parts. The incisor region of the left maxilla is missing. Judging from the condition of the right maxilla there was some degree of subnasal pragnathism present.

The mandible is massive and the teeth are moderately worn. The height of the symphysis is 36·5 mm. and the height of the body is 34·0 mm. Both the ascending rami are broken and the coronoid and condyloid process missing. The chin is not prominent.

The skull was very badly broken and warped and the measurements can only be regarded as approximately correct. We have, therefore, not included them in the Tables, but give them separately below :—

Maximum Cranial Length	172 mm.
Nasion Inion Line	165 ,,
Bimastoid Breadth	123 ,,
Auricular Height	118 ,,
Basi-Bregmatic Height	141 ,,
Length of Foramen Magnum	33 ,,
Breadth of Foramen Magnum	28 ,,
Depth of Palate	13 ,,

The skull appears to have been that of an adult male.

Skull No. 26 (Text-Fig. 35)

This skull, which was the only part of the skeleton to be found, is much broken, and extensive reconstruction has been necessary. So far as we can judge, it appears to have been the remains of a young female. The bones are light and thin and the frontal region presents well marked eminences, while there is but little development of the glabella and superciliary ridges. A great part of the skull is missing, including the whole of the basis cranii, the posterior part of the frontal, and much of the parietal bones in the region of the bregma and coronal suture, the whole of the occiput, except a small part of the supra-occipital area, the squamous plate of the left temporal bone, and the whole of the left side of the face. In its general character this skull appears to agree with the other members of the mesocranial Mediterranean group.

Norma facialis.

The forehead is rounded and the frontal eminences are fairly well marked. The glabella and superciliary ridges are only slightly developed. The orbits are high ; the orbital index is as high as 94·4 (hypsiconch). The malar bones are not prominent. The root of the nose is slightly depressed, and the nose appears to have been of moderate length; there is a tendency to the formation of a subnasal gutter.

Norma lateralis (Text-Fig. 35).

As mentioned already, the glabella is not marked and there is but slight depression at the root of the nose. The nose itself appears to have had a moderately high pitch to the bridge.

Norma verticalis.

So far as we can judge, the skull was probably mesocranial or high dolichocranial. The parietal eminences are moderately well marked. There is no trace of synoštosis of the sutures. On the whole the skull would appear, from such parts of it that are left, to conform to Sergi's "ovoides" type.

Fig. 35.

Skull M (Text-Fig. 36; Pl. CLXI, Fig. 22)

This skull reached us bearing no number. It is in a bad štate of preservation and a large part is missing, but, as it is of a particularly intereśting type, we give such account of it as is possible. The skull appears to have belonged to a male in the prime of life. All the teeth appear to have been cut, and there is no trace of any synoštosis in those parts of the sutures that can štill be traced, except possibly in the lateral part of the coronoid suture. The size of the cranium is large, the bones are thick, and the muscular attachments are well developed. The thickness of the frontal bone is 6 mm., and that of the parietal is 7 mm.

Norma facialis.

Nearly the whole of the facial part of the skull is missing; all that we have been able to save consišts of fragments of the maxillæ. In addition, almošt the whole of the right side of the cranium is absent, as well as a large part of the left parietal bone and a portion of the squamous plate of the temporal. The glabella and superciliary ridges are well developed. There is a wide supra-orbital notch on the right side, and a supra-orbital foramen on the left.

Norma lateralis (Text-Fig 36).

When viewed from this angle it is clear that the skull is remarkably long, its great length being due in the main to the great development of the occipital region and the part lying posterior to the external auditory meatus ; the meatal position index is 52·36.

Norma verticalis.

Viewed from above the elongate nature of the skull is very marked. The general outline of the skull, judging from that part of it that still remains, would probably conform to Sergi's "ovoides" type. The parietal eminences were apparently not marked.

Norma occipitalis.

There is a wormian bone at the lambda that measures 17 mm. in length by 14 mm. in breadth. The superior nuchal lines are raised into a well-defined ridge, that extends from the inion as far as the asterion.
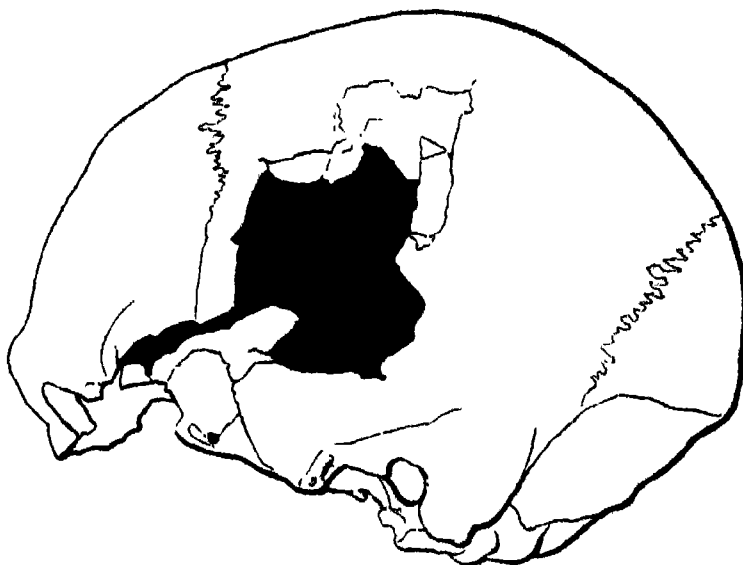
Fig. 36.

Norma basilaris.

Extending across the whole width of the basis cranii is a crack that reaches from mastoid to mastoid, running through the foramen magnum ; the two parts of the skull have to some extent become separated, the gap between them being about 7 mm. wide. Apart from this crack the margin of the foramen is intact. Even when allowance has been made for the separation, the shape of the foramen during life must have been oval or pyriform, the major diameter lying about the junction of the middle and posterior thirds. The glenoid cavity is deep. The tympanic plates are thick and massive.

The Mandible.

The greater part of the mandible was preserved, but has undergone a considerable degree of warping. The body is of stout build. The teeth in both the mandible and maxillæ are markedly worn, the dentine being freely exposed ; the actual degree of wear becomes

considerably greater as we pass from the third to the first molar teeth. The degree of wear of the incisors clearly demonstrates that the teeth during life met in an " edge to edge " bite. The dental arcade is somewhat narrow anteriorly ; the bicanine diameter is only 28 mm., but the bimolar diameter must have been in the neighbourhood of 60 mm. The chin is not prominent.

Cranial Capacity.

In a number of these skulls it has not been possible to obtain reliable measurements of the three dimensions, namely, the length, breadth, and auricular height. It has not, therefore, been possible for us to calculate the cranial capacity by means of Lee and Pearson's formulæ,[1] neither have we been able in any instance to take a direct measurement, owing to the fragile or incomplete character of the skulls. In those cases where Lee and Pearson's formulæ could not be applied, we have made use of the formulæ given by Wingate Todd.[2] It must be borne in mind, however, that his formulæ were calculated for the crania of the white races inhabiting America, and may not, therefore, give very reliable results when applied to skulls of an entirely different character, especially those of the Proto-Australoid race. In the following table we give the various capacities calculated according to these two methods :

No. of skull.	*Lee and Pearson's formulæ.*	*Wingate Todd's formulæ.* Length.	Breadth.	Height.	*Average.*
	ccs.	ccs.	ccs.	ccs.	ccs.
1	1265·97	1351·98	1183·98	1327·51	1282·36
2	—	1487·08	—	1399·60	1443·34
6	1201·71	1371·75	1232·60	1341·94	1286·99
7	1268·56	—	—	—	1268·56
8	1345·44	1375·05	1242·33	1399·66	1340·62
10	—	1375·05[3]	—	1385·23[3]	1380·14
11	1551·52	1480·49	1316·66	1515·10	1515·70
14	1157·4	1276·20[3]	1349·36[3]	1184·35[3]	1241·83
19	—	1434·36	—	1270·44	1352·40
26	—	—	1222·87[3]	1414·09[3]	1318·48
M–	1494·19	1506·85	1225·98	1500·67	1500·57

From the above results it can be seen that on the whole the figure for the cranial capacity given by Wingate Todd's formulæ and calculated from the breadth measurement is considerably below the figure obtained by the other methods ; almost the only exception to this is to be found in Skull No. 14. Soren Hansen [4] has maintained that in fossil skulls very little reliance can be placed on the cephalic index as deduced from the length and breadth measurements, as, owing to pressure from the superincumbent earth, these skulls are frequently deformed and in consequence the dimensions are altered. As the skull usually lies on its side, the breadth measurement will be too small, and, conversely, the length measurement will become increased. The figures given in the above table certainly appear to bear this out, for in the main the cranial capacity calculated from the breadth measurement is lower, and in certain cases very considerably lower, than the capacity calculated from either the length or the auricular height.

[1] Lee and Pearson, " A first study of the Correlation of the Human Skull " : *Phil. Trans. Roy. Soc. London*, Series A, vol. cxcvi, p. 247, London, 1901.

[2] Wingate Todd, " Cranial Capacity and Linear Dimension in White and Negro " : *Amer. Jour. Phys. Anthropol.*, vol. vi, No. 2, p. 167.

[3] These figures are probably somewhat too high, as Wingate Todd's formulæ apply to adult males only.

[4] Soren Hansen, " On Posthumous Deformation of Fossil Skulls " : *Man*, vol. xix, No. 65, p. 121, London, 1919.

On the other hand, in those cases in which it was possible to obtain all three measurements, the capacity calculated from the length or the auricular height is somewhat greater than that deduced in accordance with the Lee-Pearson formulæ, and, of course, a flattening of the skull transversely will tend to increase both the total length of a skull and its auricular height. The exception to the rule, No. 14, is the skull of a child, which is of a markedly brachycephalic type; a reference to the photograph of the skeletons, while still *in situ*, shows that in this case, unlike most of the skulls, the skull was not lying on its side but was on its back, lying on the occiput with the face upwards, so that, if there has been any flattening owing to the pressure of the earth, the skull will have been rendered more brachycephalic than it was in life, and this will have produced the increased result in the calculation of the cranial capacity from this measurement.

The Teeth.

Race.	No. of skulls.	Molar 1. Length. mm.	Molar 1. Breadth. mm.	Molar 1. Index.	Molar 2. Length. mm.	Molar 2. Breadth. mm.	Molar 2. Index.
Mohenjo-daro, Nos. 2, 11, M-:— Proto-Australoid type	3	10·25	10·0	97·56	10·2	9·85	96·57
Melanesians	20	11·42	10·96	96·0	10·69	10·55	98·7
Australian aborigines	11	10·8–12·7	10·0–12·2	—	11·0–12·2	10·3–11·9	—
" "	6	11·4	11·7	102·5	12·2	11·8	96·1
Mohenjo-daro, No. 13*b* (3):— Mongolian type	1	10·37	10·62	102·41	11·0	10·12	92·05
Chinese	2	11·2	11·4	101·8	10·8	10·8	100·0
Mohenjo-daro, Nos. 6, 7, 9, 10, 19, 26:— Mediterranean type	6	10·53	10·84	102·94	6·69	10·30	106·71
Nāl Skull, Mediterranean	1	11·25	13·0	115·56	10·62	11·75	110·59
Mohenjo-daro, No. 20:— Alpine type	1	11·18	10·95	97·95	10·77	10·63	98·70

From the above it may be seen that there is on the whole a very fair agreement as regards the length-breadth indices of the two first molar teeth between the Proto-Australoid type of skull found at Mohenjo-daro and those of the aboriginal Australians and Tasmanians. In two of the three groups the index of the first molar tooth is higher than that of the second, the exception being the Melanesians; and, further, the index of the Mohenjo-daro skulls falls between those of the other two groups.

As in most early skulls, the teeth are badly worn, the dentine being freely exposed. The only skulls that are exceptions to this general rule are No. 1, which is comparatively recent, and No. 7. Sergi, Buxton, and Keith have all commented on the degree of wear in the teeth of the skulls from Anau, Kish, and Al-'Ubaid respectively, and we have also noted its presence in the Nāl skull.

Conclusions.

In spite of the fragmentary nature of some of the skulls and the degree of warping that others have undergone, it is, we think, possible and justifiable to draw certain conclusions from the material before us. The skulls are, without doubt, not a homogeneous series, and there seems to be evidence that at least four different types are represented.

Type I. Proto-Australoid Race

To this type belong skulls Nos. 2, 11, and M. All these three skulls are remarkably long and fall in the dolichocranial group; the individual indices of the two skulls, that are sufficiently complete to enable us to determine the index, are 68·72 (No. 11) and 63·32

(No. M), the average of the two being 66·02. The sides of the skull are flattened and appear to rise nearly vertically from the mastoid region. The vertex is highly arched, the average height index being 70·68, while the average auricular height is 122 mm. As pointed out in the case of skull No. 11, there may be a tendency to scaphocephaly. The proportion of the skull that lies behind the level of the external auditory meatus is extraordinarily high, the meatus lying nearly midway between the nasion and the inion. As already mentioned (*vide supra*, p. 607), Keith [1] has called attention to this feature in the long crania of the Veddahs, and, more recently,[2] in his Report on the human remains excavated at Al-'Ubaid and Ur. Up to the present time but few anthropologists have paid any attention to this feature, and we are, therefore, not in possession of data from other collections that we can make use of for the purpose of comparison. In order as far as possible to remedy this defect, we have calculated the auditory-meatus-position index (*vide supra*, p. 607) from measurements taken on dioptographic tracings of Australian,[3] Tasmanian,[4] and Veddah [5] skulls, as well as from three skulls of a similar type from Ādittanallur. In the table below we have given the auditory-meatus-position index in the skulls before us, as well as those calculated from the data given in the various works referred to :—

Race.	*No. of Crania.*	*Auditory Meatus Position Index.*
Mohenjo-daro, Nos. 2, 11, and M- .	3	48·1
Veddah	5	51·43
Tasmanian	20	51·49
Australian	20	53·01
Ādittanallur	3	54·60

From the above it is clear that there is a very close degree of similarity between the different groups, which form a consecutive series.

The superior nuchal lines in all three skulls are well developed, and the individuals appear to have been of muscular development. The glabella is well marked and the superciliary ridges also tend towards a high degree of development. The nose seems to have been comparatively broad, but was also moderately arched. In one of the skulls (No. 11) there was some degree of subnasal prognathism. In those cases where the anterior teeth are still present it is clear that the upper and lower incisors met in an " edge to edge " bite and did not overlap, as in the case of most modern skulls. Keith [6] has stated that this " edge to edge " bite is common in early skulls and in all primitive races. We cannot, therefore, lay much stress on its occurrence in these skulls from Mohenjo-daro, but it is interesting to note that Turner [7] has called attention to the fact that this type of " bite " is a characteristic of skulls

[1] Sir Arthur Keith, " Report on two crania of considerable but uncertain Antiquity " : *Journ. Anthropol. Soc. Bombay*, vol. xi, p. 671, Bombay.

[2] Sir Arthur Keith, " Report on the Human Remains " in H. R. Hall, *Ur Excavations*, vol. i (Al-'Ubaid), p. 232, 1927, Oxford.

[3] R. J. Berry and A. W. D. Robertson, " Dioptographic Tracings in three normæ of 90 Australian Aboriginal Crania " : *Trans. Roy. Soc. Victoria*, vol. vi, 1914.

[4] R. J. Berry and A. W. D. Robertson, " Dioptographic Tracings in four normæ of 52 Tasmanian Crania " : *Trans. Roy. Soc. Victoria*, vol. v, 1909.

[5] (*a*) P. and F. Sarasin, *Ergebnisse naturwissenschaftlicher Forschungen auf Ceylon*, vol. iii, *Die Weddas von Ceylon und die sie umgebenden Völkerschaften*, Wiesbaden, 1892–3. (*b*) A. Keith, loc. cit.

[6] Sir Arthur Keith, *The Antiquity of Man*, vol. ii, p. 670, London, 1925.

[7] Sir W. Turner, " The Relations of the Dentary Arcades in the Crania of Australians " : *Journ. Anat. and Physiol.*, vol. xxv, p. 463, London, 1891.

of the Australoid group. The cranial capacity of the skulls is comparatively large. We have given above on page 637 the calculated cranial capacities of all the skulls under consideration, and it is clear that these three skulls, Nos. 2, 11, and M, have a considerably greater capacity than the others. It is interesting to compare the size of the cranium in other races that belong to the same type ; we have, therefore, in the following table given certain data on this point :—

Geological period.	*Race.*	*Author.*	*No. of skulls.*	*Cranial capacity, Average.*
Pleistocene	Java, Wadjak	Dubois	2	1600 ccs.
"	Europe, N. Africa	Boule	4	1450 "
"	Australian (Talgai)	E. Smith	1	1300 "
"	Rhodesia	Boule	1	1280 "
Recent	Proto-Australoid			
"	Mohenjo-daro	—	3	1490 "
"	Ādittanallur	—	4	1532 "
"	Tasmanian	Martin	—	1406 "
		Martin	—	1347 "
"	Australians	Boule	—	1340 "
		Keith	—	1287 "
"	Veddahs	Sarasin	18	1278 "

There is thus very close agreement between the present skulls from Mohenjo-daro, the recent extinct Tasmanian race, and the prehistoric *Homo neanderthalensis* from Europe and North Africa, the cranial capacity falling between 1400 and 1500 ccs. The Rhodesian skull falls very near the Veddahs, having a very considerably reduced capacity, namely, 1278–80 ccs., and is only just surpassed by the Talgai skull and the modern Australian Aboriginal. The lower jaw in these skulls is very strongly built, with a wide bigonial diameter, and a short ascending ramus. There can, we think, be little doubt that the skulls of this type must be referred to the Proto-Australoid Race. Among the skulls that have been excavated at Ādittanallur there are some of the same type and these have been definitely referred to the Proto-Australoid race by Elliot Smith.[1] In addition to the evidence of the skulls, we have a certain amount of information regarding the living height of the individuals of this group. As mentioned above (*vide supra*, p. 604), the data supplied by the Camp Medical Officer gives the length of two long bones, namely, the tibia and fibula, in skeleton No. 11, and from these measurements the calculated living height of the individual would be in the neighbourhood of 1553 mm. or 5 feet and 1 inch. This is distinctly on the small side, and agrees with what we should expect to find in an individual of the Proto-Australoid race.

A comparison of the skulls excavated at Mohenjo-daro with those discovered at Kish and described by Buxton[2] appears to us to indicate that certain of the Kish skulls agree in certain characteristics very closely with those from Mohenjo-daro that we attribute to Type I. Buxton remarks : " The skulls are relatively long and narrow, of small cubic dimensions and occasionally of massive appearance, with heavy brow ridges and a keel-shaped top to their heads." As regards the cubic dimensions of these massive skulls from Kish, the cranial capacity as given by Buxton for Kish skull No. 3 is 1409 ccs. ; for No. 5, 1420 ; and for

[1] G. Elliot Smith, *The Evolution of Man*, p. 130.

[2] L. H. D. Buxton, " On the Human Remains excavated at Kish " in S. Langdon, *Excavations at Kish*, vol. i, pp. 115–25, Paris, 1925.

No. 7, 1431. All three of these skulls belong to his massive type, and their corresponding cranial indices are respectively 66·84, 69·43, and 67·70, thus giving an average of 67·42. It is a matter of some difficulty to compare our skulls with the account given by Buxton, as we have been unable to discover to which, if indeed to any, standard of measurement he is conforming, and he further makes use of terms that do not appear in any of the recognized conventions; for instance, he gives a "palato-maxillary breadth" and "palato-maxillary length" and from these deduces a "palato-maxillary index"; but, so far as we can ascertain, and judging from the dimensions that he gives, he is referring to the palatal length and breadth of the International Agreement. Keith[1] in his recent account of the skulls excavated at Al-'Ubaid and Ur also appears to have had certain skulls that conform very closely to this type, especially Nos. I, II, III, IV, and VII of the Al-'Ubaid skulls. A comparison of the photographs given by us, Pl. CLXI, Figs. 14, 15, and 22 and Text-Figs. 14 and 36, with those given by Buxton (loc. cit., pl. xlvi, figs. 1, 3, and 6, and pl. xlvii, fig. 1) and the tracings given by Keith (loc. cit., pls. lxiii–lxvii) sufficiently indicates how close is the resemblance.

In the Table below we have given some of the characters of the skulls of the present type from Mohenjo-daro, and for the purpose of comparison we have also given these characters for the "massive type" skulls from Kish (Buxton), certain skulls from Al-'Ubaid (Keith), the Veddahs (Sarasin), and a series of nine skulls from Ādittanallur :—

	Kish Nos. 3, 5, 7 (*Buxton*).	*Al-'Ubaid Nos.* 1, 2, 3, 4 *and* 7 (*Keith*).	*Mohenjo-daro Nos.* 2, 11, M.	*Ādittanallur* 9 *skulls*.	*Veddah* (*Sarasin*).
	ccs.	ccs.	ccs.	ccs.	ccs.
Cranial capacity	1417	1498·5	1490	1532	1278
Cranial index	67·42	72·6	66·02	69·7	70·5
Length-height index	69·9	71·26	70·68	70·58	73·7
Auricular height index	—	62·2	60·03	67·06	—
Upper facial index	49·6	55·1	53·93	50·45	51·4
Total facial index	—	92·06	88·98	—	88·2
Nasal index	44·4	49·2	51·06	51·62	52·7
Nasal length	54·0 (No. 3)	53·3	46·5	52	46·9
Orbital index	72·7	83·4	84·46	85·86	89·8
Palatal index	67·3	—	89·36	89·32	77·0
Bizygomatic width	125	127·6	127·0	130·5	123·5

It seems to us that all the above series show evidence of relationship. As regards the cranial index, the skulls from Al-'Ubaid are not so elongated as those from Mohenjo-daro, but the skulls from the other localities form a series of connecting links. In the facial part of the skull, the individuals from Al-'Ubaid have a considerably longer face than those from Kish; the Ādittanallur skulls tend to approximate to the Kish type, while the Mohenjo-daro skulls are nearer to those from Al-'Ubaid. As regards both the nasal and orbital indices, we have a regular graded series commencing in the Kish skulls with a nose that is long and narrow; in the Al-'Ubaid skulls the nose is slightly shorter and distinctly broader, and these changes are even more marked in the Ādittanallur and Mohenjo-daro skulls, which have chamærrhine noses, and finally the maximum alteration is found in the Veddahs. Similarly, the orbit is very low in the Kish skulls and reaches its maximum height in the Veddahs. Another alteration in the character in the face is the change from orthognathism to prognathism. In

[1] Sir Arthur Keith, "Report on the Human Remains" in Hall, *Ur Excavations*, vol. i, Al-'Ubaid, pp. 214–40, Oxford, 1927.

the Kish skulls there is marked alveolar prognathism (*vide* Buxton, pp. 115, 116), in the Al-'Ubaid there is, according to Keith, no trace of prognathism, but in the Mohenjo-daro and Ādittanallur skulls prognathism is again evident.

In the Al-'Ubaid skulls the supra-orbital ridges are well developed; in the whole series Keith gives an average measurement of 103·8. In the three skulls from Mohenjo-daro this measurement is 104·7, and three skulls from Ādittanallur gives the same average measurement as that of the Al-'Ubaid skulls. The bizygomatic breadth, again, shows a graded series from the Kish to the Ādittanallur skulls.

Keith has called attention to the importance of the facial projection in the antero-posterior plane in determining relationships. Beyond the data given by Keith we have no basis of comparison. In these skulls from Mohenjo-daro the orbital margin is very nearly the same distance in front of the meatal plane as in the Al-'Ubaid skulls, the measurements being 69·7 and 70·6 respectively; but the forward projection of the cheeks as shown by the position of the malo-maxillary point is considerably greater in the Mohenjo-daro skulls, being 73·0 mm. as opposed to 70·2 in those from Al-'Ubaid. The nose is markedly less prominent in the Mohenjo-daro skull, the distance from the front margin of the orbit being only 15 mm., while in the Al-'Ubaid skulls it is 20 mm. Associated with this, there is in the Mohenjo-daro skulls a marked depression of the nasion.

Keith (pp. 215–16) remarks: "If we look at a map of Asia on which the areas occupied by the various racial divisions of mankind are indicated . . . we see that Mesopotamia lies along a racial watershed or zone of transition. To the south and west lies the whole of the great Arabian peninsula, from the Indian ocean to the Levant, marked as the home of the Semites; to the north and east the homeland of the Iranians stretches from the valley of the Indus to the Black Sea", and he points out that the inhabitants of Al-'Ubaid partook of the characters of both races and represent a transitional stage between the two types. Mohenjo-daro, lying near the mouth of the Indus, may be said to be between the homeland of the Iranians and peninsular India, the homeland of the Proto-Australoids.

Type II. Mediterranean Race

To this type we attribute skulls Nos. 6, 7, 9, 10, 19, and 26. These skulls are of considerably less size than those of Type I, the average cranial capacity being only 1332·5 ccs. The shape of the skull is long and moderately long, the average cranial index being 67·67; this is, however, probably slightly too low, for included in the series is one skull that gives a cranial index of only 57·45, and this is in the main due to posthumous compression and fracture. The sides of the skull in this type are not so flattened as in Type I, but tend to bulge somewhat above the mastoid region. Both frontal and parietal eminences are, as a rule, fairly well marked. The proportion of the cranium that lies behind the external auditory meatus is high, the average meatus position index being 52·81. This is appreciably higher than the index in the Proto-Australoid skulls of Type I, which is only 48·1, but is not higher than the average index in the Proto-Australoid skulls from Ādittanallur or in the Australian skulls. The muscular attachments are not so markedly developed in this series. The glabella is, as a rule, only slightly prominent, and the superciliary ridges are not pronounced. The nasion is not depressed. The nasal index is on the average 48·63, falling in the low range of the mesorrhine group. The actual nasal length varies from 41 mm. to 52·25 mm., the average being 46 mm., so that the nose tends to be short. The interorbital width is narrow, varying between 21 and 26 mm., and the bridge of the nose is narrow and high-pitched; in attempting to estimate the degree of prominence of the nose we have

followed the method proposed by Keith,[1] taking the distance between the anterior inferior margin of the orbit and the most prominent part of the nose as shown on the craniogram. The average projection is 26·1 mm., and ranges between 24·0 mm. and 33·5 mm. The mandible is of slight build, and the average bigonial breadth is only 84 mm.

This type of skull we consider to represent the true Mediterranean race, and the examples in the present collection agree very well with the "Nāl" skull from Balūchistān and Skull No. 4 in Buxton's account of the Kish remains. In the following table we have given the various characteristic indices, etc., of the skulls that we attribute to this Mediterranean type, and for the purpose of comparison we have also given the corresponding indices, etc., for the Kish skull No. 4, as recorded by Buxton,[2] skulls Nos. 1 and 2 from Anau, recorded by Sergi,[3] three male skulls from Ur, recorded by Keith, and the "Siālkot" and "Bayāna" crania.

Character.	*Mohenjo-daro Skulls, 6, 7, 9, 10, 19, and 26. Average.*	*Nāl cranium.*	*Ur-Skulls ♂ (Keith).*	*Kish Skull No. 4.*	*Anau Skulls Nos. 1, 2.*	*"Siālkot" Skull.*	*"Bayāna" Skull.*
Cranial capacity . .	1332·5	1443·2[4]	1413·5	1328	1378·1[4]	1360[4]	1250·5
Cranial index . .	66·2	70·0	69·8	69·1	76·2	71·1	71·3
Length-height index .	75·23	77·45	72·65	66·49	—	77·78	73·60
Auricular height index	64·02	63·83	60·0	—	57·84	66·11	60·67
Facial index . .	—	60·0	57·97	45·2	—	—	—
Nasal index . .	48·2	46·9	48·77	44·4	46·8	—	—
Orbital index . .	88·11	82·5	90·0	86·84	83·3	—	—
Palatal index . .	79·16	79·25	—	75·0	—	—	—

There can, we think, be little doubt that all these skulls belong to the same type. So far as the individual differences shown in the table are concerned, especially the differences in the length-height index of the cranium and the various indices of the face, it is possible that we have here evidence of a tendency to the development of separate local races within the limits of a single group, as has been suggested by Buxton,[2] but one is not justified in arriving at any definite conclusion in the matter owing to the comparatively few skulls available at the present time from any one of these localities. Among the data that we possess, we have evidence of one sort or another regarding the living height of three individuals belonging to this type, namely, of one man and two women. The male was about 5 ft. 4½ in. The two women are considerably shorter than this, measuring, respectively, 4 ft. 9 in. and 4 ft. 4½ in., or an average height of 4 ft. 6¾ in.

Type III. Mongolian Branch of the Alpine Stock

This type is represented by a single skull, No. 13 *b* (3). The skull is quite characteristic, and for the purpose of comparison we have given both side and face views of a Nāga skull, No. N. 189, in the Indian Museum collection (*cf.* Pl. CLX, Figs. 5 and 6 and 7 and 8). The close correspondence between the two leaves no room for doubt regarding the racial origin of the individual.

[1] Sir Arthur Keith, "Human Skulls from Ancient Cemeteries in the Tarim Basin": *Journ. R. Ant. Inst. of Great Britain and Ireland*, vol. lix, p. 167. London, 1929.

[2] L. H. D. Buxton, "On the Human Remains Excavated at Kish" in S. Langdon, *Excavations at Kish*, vol. i, p. 122, Paris, 1924.

[3] G. Sergi, "Description of some skulls from the North Kurgan Anau" in Pumpelly, *Explorations in Turkestan*, vol. ii, p. 446, Washington, 1908.

[4] Estimated according to Lee-Pearson formulæ Nos. 10 and 11.

TYPE IV. ALPINE

In the present series there is only one skull that can be definitely shown to be brachycephalic, namely, that of the child, No. 14. There are, however, certain other skulls that seem to us to have, in all probability, belonged to this group, namely skulls No. 8, 13, and 20. Unfortunately, all these skulls are in a poor state of preservation, and it is only on No. 8 that we have been able to take definite measurements, and even in this case the skull was badly damaged. No. 13 is the skull of a female, which lay close to No. 14, the brachycephalic child; this skull was very badly damaged, the cranial portion was in two parts, but the left half of the frontal bone, part of the left parietal, and the left temporal bones were more or less intact. The occipital bone was fractured down the middle line, but clearly showed that the supra-occipital region was composed of two large wormian bones of about equal size; the right parietal and part of the right temporal bones were impacted in the right half of the cranium, and the whole of the face and the basis crani were missing. The bones were extremely thin and fragile, and an attempt to reconstruct the skull proved disastrous. So far as we could judge, the skull must have been at least a high mesocranial, and may even have been brachycranial, though not so markedly so as Skull No. 14. That this individual was a female we have no doubt, and if she was, as we are inclined to believe, the mother of No. 14, it is only to be expected that the child would exhibit a greater degree of brachycephaly. Skull No. 20 was one of those that had been left *in situ* for a year, and when it was removed for examination was in a very bad state of preservation. The nasal and maxillary portions of the face were completely separated and partially missing; the whole of the vault of the skull and the greater part of the occipital area were wanting, as also were the left temporal region and the mastoid. The mandible was without either ascending ramus. As a result, it is impossible to arrive at any definite conclusion regarding the original shape of the skull, but we are of opinion that it was in all probability brachycranial. There is sufficient of the posterior region to show that the skull was not a long one (*vide* Text-Fig. 34), nor does it exhibit any tendency to the posterior prolongation of the cranium behind the level of the external auditory meatus, a feature that is so characteristic of the skulls of the Proto-Australoid and Mediterranean types. It seems probable that all four skulls of this group belonged to the Alpine race, but beyond this it is impossible to go, and we are not in a position to determine to which branch of the Alpines they may have belonged. The only indication regarding the probable living height of the individuals of this group is derived from Skeleton No. 20, in which the maximum height, as it lay, was 5 ft. 5½ in.

In conclusion, we would express our thanks to Messrs. Provash Chandra Basu, M.Sc., Bajra K. Chatterjee, M.Sc., and Panchkori Chakravarty, who have given us very considerable assistance in calculating indices and in compiling the various tables.

TABLE I.—MEASUREMENTS

Sr. No.	Skull	1 ♀	2 ♂	3 ♂ (13 b.)	6 ♂	7 ♀	8 ♂	9 ♂	10 ♀	11 ♂	12 ♂	infant. 14	19 ♀	26 ♀	M. ♂	Average.
		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1	Maximum cranial length	175·5	196	180·5 ?	178·5	173·5	172	—	179	195	—	164	188	—	199	181·81
2	Maximum cranial breadth	123	—	138·5 ?	128	120·5 ?	131	—	—	134 ?	—	140	108 ?	118	126	127·6
3	Cranial height—															
	(a) Auricular height	112	117 ?	120 ?	113	124	117	—	116	125	—	100	108 ?	118	124	116·16
	(b) Basilo-bregmatic	131	—	133 ?	132	140 ?	130	—	140	137·5	—	118·5	128	—	141	133
4	Least frontal breadth	91·5	93·5	95	93	87	93	83 ?	83 ?	95	—	85 ?	82	90	97	89·84
5	Greatest frontal breadth	108	—	108	113	—	110	—	—	115	—	112	—	—	—	111
6	Bimastoid breadth	96·5	—	—	—	—	—	—	—	116 ?	—	104	90 ?	—	115	104
7	Bizygomatic breadth	117·5	—	140 ?	—	—	124	—	—	127 ?	—	—	94 ?	—	—	120·5
8	Bimalar breadth	—	—	—	—	96 ?	94	—	92 ?	—	—	88	—	—	—	92·5
9	Nasal length	48·25	—	53	47	44·25	46	45	52·25	47·5	—	40	47	41	—	46·43
10	Nasal breadth	20·5	—	26	23	22·5	26	—	25	24 ?	—	19·5	21	20	—	22
11	Interorbital breadth	19	—	23	19·25	18·5	24	22	22	21	—	21·5	17	22	25 ?	21·10
12	Do. (dacryon)	21	—	27·5	—	—	—	—	—	27	—	—	—	—	—	25
13	Orbital breadth	37 L 36·5 R	—	38	36	37·75	41	36	41·25	37	—	34·5	38 L 35·5 R	36	—	37·36
14	Orbital height	33·5 L 32·75 R	—	37·5	30·5	31·25	29·5	34	35·5	31·25	—	31	31 L 32·5 R	34	—	32·67
15	Nasion prosthion line	64	—	74	67	58·25	64	—	—	68·5	—	—	—	59	—	64·96
16	Nasion basion line	97	93	110	101	—	—	—	102	104·5	—	88	95	—	102	99
17	Prosthion basion line	81·25	—	109	101	—	—	—	—	102	—	—	60	—	—	90·5
18	Nasion gnathion line	103	—	—	114	—	116	—	—	113	—	—	99·5	—	—	109·1
19	Maxillo alveolar breadth	57	—	74	66	—	64	—	—	94 ?	—	60	56	—	72 ?	67·87
20	Maxillo alveolar length	48·5	—	53	58	—	60	—	—	74 ?	—	—	52	—	58 ?	57·64
21	Palatal length	39	—	49	50·5	—	56·5	—	—	65·25 ?	—	31	42	—	42	46·90
22	Palatal breadth	36	—	47	41·5	—	40	—	—	51 ?	—	34	33	—	42 ?	40·56
23	Occipital foramen—															
	(a) length	32·25	39	—	36·5	—	—	—	35·5	33·5	—	34	—	—	42	36
	(b) breadth	26	22	—	28·5	—	—	—	26	26	—	28·5	—	—	30	26·5
24	Binauricular breadth	109·25	—	—	—	—	117	—	—	115	—	115·5	—	—	—	114
25	Outer biorbital breadth	96·25	—	112	103	—	—	—	—	104 ?	—	96	—	—	—	102·5
26	Inner biorbital breadth	88	—	100·5	94	—	—	—	—	98·5 ?	—	87	—	—	—	93·6
	Bimaxillary breadth.	89·5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Bimastoid	—	—	—	—	—	120	—	—	—	—	—	—	—	—	—
	Height of palate	—	—	—	—	—	11	—	—	—	—	—	—	—	—	—
	Palatal depth	8·5	—	15·5	14	13	—	19	—	15 B.Ca. 38 B.M.60.5	—	10	—	13	—	13·5
27	Greatest occipital breadth	94·5	—	—	—	—	121	—	—	128 ?	—	124·5	—	—	—	117
28	Sagittal cranial arc	346·5	—	340	—	366 ?	370	—	386	399	—	343	—	—	402	369·06
29	Transverse cranial arc	272	—	318 ?	290	285 ?	282	—	—	—	—	300	290	—	326	295
30	Horizontal circumference (maximum)	464	—	503	558 ?	475	491	—	448	—	—	479	480 ?	—	532	491
31	Biorbital nasal arc	98	—	111	100	—	—	—	—	102 ?	—	—	—	—	—	102·75
32	Frontal arc	128	—	—	135	—	—	—	—	—	—	—	—	—	—	131·5
33	Parietal arc	114·5	—	—	—	—	—	—	—	—	—	—	—	—	—	114·5
34	Occipital arc.	102·5	—	—	—	—	—	—	—	—	—	—	—	—	—	102·5
35	Nasion lambda line	160·5	—	—	—	—	—	—	—	—	—	—	—	—	—	160·5
36	Basion lambda line	104	—	—	—	—	—	—	—	—	—	—	—	—	—	104
37	Nasion inion line	161	187	—	—	—	—	—	—	—	—	—	—	—	—	174
38	The position of ext. aud. meatus—					—	—	—	—	—	—	—	—	—	—	—
	(a) distance from the centre to ext. occi. port.	76	—	95	85	120(L.90)	83	—	72	100	—	76	—	—	91	87
	(b) distance from the centre to nasion	93	—	100	97	63 (L. 88)	89	—	114	96	—	83	—	—	100	94·16
39	Frontal chord (nasion bregma)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	THE MANDIBLE															
40	Bigonial breadth	90·5	98	—	—	—	90	—	—	105	—	—	78	—	—	92·3
41	Height of the ramus	49·5	61	49·5	59	—	47	49·5	—	63	—	—	38	—	65	53·5
42	Breadth of the ramus—															
	(a) maximum	39·5	46	49	44	—	41	46	—	46·5	—	—	37	—	—	43·62
	(b) minimum.	31·5	38	32	33·75	—	29	30·25	—	36·5	32	—	30	—	42	33·5
43	Symphyseal height	25	36·5 ?	34·5 ?	31	—	34	—	—	32·5	—	—	25	—	32	31·31
44	Mandibular length	69·5	81·5	—	72	—	65	—	—	79·5	—	—	—	—	—	73·5
45	Mandibular angle.	122°	116°	126°	—	—	122°	133°	—	118°	120°	—	132°	—	105°	121° 55′
46	Bicondylar breadth	110·5	118 ?	—	106·5	—	116·5	—	—	114	—	107	67	—	90	103·5
47	Height of the body of the mandible	—	—	—	—	—	33	—	—	—	—	—	—	—	—	33
	Right side	22	31	—	30	—	—	—	—	—	—	—	23	—	35	28
	Left side	23	32	—	30	—	—	—	—	—	—	—	—	—	—	28

TABLE I.—MEASUREMENTS (*Continued*)

Skull				1 ♀	2 ♂	3 ? (13 b).	6 ♂	7 ♀	8 ♂	9 ♂	10 ♀	11 ♂	12	14 infant	19 ♀	26 ♀	M. ♂	Average.
				mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Teeth. Upper Jaw	Right side	Antero post diameter	1st molar	10	—	9	10	10·75	—	10·25	9·5	—	—	10·5	10	11	—	10·07
			2nd molar	8·5	—	9·75	10	11	—	9·5	9·5	10	—	—	8	10·5	10	9·65
			3rd molar	—	—	—	9·5	—	—	10	—	8	—	—	—	—	10	9·5
		breadth	1st molar	10·5	—	11	11·25	12	—	11	11·25	—	—	11·25	11	12	—	11·24
			2nd molar	10	—	11·25	11	11·5	—	11	11	11	—	—	10·5	11	10·5	10·88
			3rd molar	—	—	—	10·5	—	—	10·5	—	10	—	—	—	—	7·5	9·62
	Left side	Antero post diameter	1st molar	9·5	—	10	10·25	—	—	—	—	9·75	—	—	9·5	—	11	10
			2nd molar	10	—	10	10	—	—	—	—	9·5	—	—	8·5	—	9·75	9·62
			3rd molar	—	—	9·75	10	—	—	—	—	—	—	—	—	—	8	9
			2nd premolar	—	—	—	—	—	—	—	—	—	—	—	—	—	6	6
		breadth	1st molar	10·5	—	11	11	—	—	—	—	11	—	—	11	—	11	10·88
			2nd premolar	10	—	11	10·5	—	—	—	—	10·5	—	—	10·25	—	11	10·55
			3rd molar	—	—	9	11	—	—	—	—	—	—	—	—	—	10	10
			2nd molar	—	—	—	—	—	—	—	—	—	—	—	—	—	8·5	8·5
Lower Jaw	Right side	Antero post diameter	1st molar	10·25	—	10·5	11	—	—	—	—	—	10·5	—	11	—	—	10·6
			2nd molar	10	10·75	11	10	—	—	—	—	—	10·5	—	9	—	10	10·17
			3rd molar	9·3	—	—	10·5	—	—	—	—	—	—	—	—	—	—	9·9
		breadth	1st molar	10·5	—	10·25	11·5	—	—	—	—	—	10	—	10	—	—	10·22
			2nd molar	10	10·25	10·25	10·25	—	—	—	—	—	9·75	—	8·5	—	9·5	9·63
			3rd molar	9·25	—	—	10·5	—	—	—	—	—	—	—	—	—	—	9·85
	Left side	Antero post diameter	1st molar	—	—	10·25	11	10·25	—	—	—	—	—	—	11	—	10	10·5
			2nd molar	10	10·5	11	10·1	9·75	—	—	—	—	—	—	10	—	9·25	10
			3rd molar	9	11	9	11	—	—	—	—	—	—	—	—	—	10	10
		breadth	1st molar	—	—	11	11	11·25	—	—	—	—	—	—	10	—	10	10·5
			2nd molar	9·9	10·5	10	10·5	11	—	—	—	—	—	—	9	—	9·25	10
			3rd molar	9	10	9·25	11	—	—	—	—	—	—	—	—	—	9	9·65
Nasion to Bregma (arc)				—	—	128	135	128	—	—	120	140	—	124	124	—	140	129·87
Nasion to Lambda (arc)				—	—	222	—	250	—	—	269	—	—	240	246	—	185	235·33
Nasion to Inion (arc)				—	—	286	—	305	312	—	331	339	—	295	315	—	348	316
Nasion to Opisthion (arc)				346·5	—	340	—	366 ?	370	—	386	399	—	343	—	—	402	369·06

TABLE II.—INDICES

Ser. No.	Skull	1 ♀	2 ♂	3 ♂ (13 b.)	6 ♂	7 ♀	8 ♂	9 ♂	10 ♀	11 ♂	12	14 infant	19 ♀	26 ♀	M. ♂	Average.
		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1	Length-breadth index	70·08	—	76·73 ?	71·71	69·45 ?	71·16	—	—	68·72 ?	—	85·37	57·45 ?	—	63·32	70·54
2	Length-height index	76·64	—	73·68 ?	73·95	80·69 ?	72·63	—	78·21	70·51	—	72·26	68·09	—	70·85	73·75
3	Length-aricular height index	63·82	59·69 ?	66·48 ?	63·30	70·47	65·36	—	64·80	64·10	—	60·98	57·45 ?	—	62·31	63·52
4	Breadth-height index	106·50	—	96·03 ?	103·13	116·18 ?	100·78	—	—	102·61 ?	—	84·64	118·52 ?	—	111·90	104·48
5	Sagittal cranial curvature index	46·46	—	—	—	—	—	—	—	—	—	—	—	—	—	46·46
6	Transverse cranial curvature index	40·16	—	—	—	—	41·49	—	—	—	—	32·00	—	—	—	37·88
7	Transverse fronto parietal index	74·39	—	68·59 ?	72·66	72·20 ?	72·09	—	—	70·90	—	60·71 ?	75·93	70·87	76·98	71·53
8	Index of the occipital foramen	80·62	56·41	—	78·08	78·08	—	—	73·24	77·61	—	82·35	—	—	71·43	74·73
9	Total facial index.	87·65	—	—	—	—	93·55	—	—	88·98 ?	—	—	105·85 ?	—	—	94·01
10	Superior facial index	54·46	—	52·86 ?	—	—	51·61	—	—	53·93 ?	—	—	—	—	—	53·21
11	Zygomatico malar index	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	Zygomatico frontal index	77·88	—	67·88 ?	—	—	75·00	—	—	74·80 ?	—	—	87·23 ?	—	—	76·56
13	Zygomatico mandibular index	77·03	—	—	—	—	72·58	—	—	82·68 ?	—	—	82·98	—	—	78·82
14	Orbital index	90·25	—	98·68	84·70	84·78	71·95	94·44	86·06	84·46	—	89·85	86·39	94·44	—	87·63
15	Nasal index	42·49	—	49·06	48·94	50·85	57·78	—	47·84	51·06 ?	—	48·60	44·68	48·78	—	49·00
16	Maxillo-alveolar index	117·53	—	138·49	113·79	—	106·67	—	—	127·03 ?	—	—	107·69	—	124·14 ?	119·31
17	Palatal index	92·31	—	95·92	82·18	—	70·89	—	—	78·16	—	109·68	78·57	—	100·00 ?	88·46
18	Mandibular index	62·89	69·07 ?	—	67·60	—	55·78	—	—	69·74	—	—	—	—	—	65·02
19	Ramus index	63·64	62·30	62·65	57·20	—	61·70	71·11	—	57·94	—	—	78·95	—	64·62	64·45
20	Longitudinal cranio facial index	46·29	—	60·39 ?	56·58	—	—	—	—	52·31	—	—	31·91	—	—	49·50
21	Transverse cranio facial index	95·52	—	101·08 ?	—	—	96·12	—	—	94·78 ?	—	—	87·04	—	—	94·91
22	Vertical cranio facial index	48·85	—	55·64 ?	50·76	41·60 ?	49·23	—	—	49·81	—	—	—	—	—	49·31

TABLE III.—AVERAGE MEASUREMENTS OF THE DIFFERENT GROUPS

Measurements.	Group A. Skulls Nos. 2, 11, M.	Group B. Skulls Nos. 6, 7, 9, 10, 19, 26.	Skull No. 3 or 13 *b*.	Skull No. 14.
Maximum cranial length	197	179·8	180·5?	164
Maximum cranial breadth	130	121·1	138·5	140
Auricular height	122	115·8	120?	100
Basilo-bregnatic height	139	130	133?	118·5
Least frontal breadth	95	86·3	95	85?
Birzygomatic breadth	127	94	140?	—
Nasal length	46·5	46·1	53	40
Nasal breadth	22	22·3	26	19·5
Interorbital breadth	23	20·1	23	21·5
Orbital breadth	37	37·3	38	34·5
Orbital height	31·25	32·8	37·5	31
Maxillo-alveolar breadth	83	61	74	60
Maxillo-alveolar length	66	55	53	—
Palatal length	53·62	46·3	49	31
Palatal breadth	46·5	37·3	47	34
Occipital foramen :—				
(*a*) Length	38	36	—	34
(*b*) Breadth	25	27·3	—	28·5
The position of ext. aud. meatus :—				
(*a*) Distance of aud. perp. from Inion	95·5	87·3	95	76
(*b*) Distance of aud. perp. from Nasion	98	95·5	100	83
Bigonial breadth	101·5	78	—	—
Mandibular angle	113°	132·5°	126°	—

TABLE IV.—AVERAGE INDICES OF THE DIFFERENT GROUPS

Indices.	Group A. Skulls Nos. 2, 11, M.	Group B. Skulls Nos. 6, 7, 9, 10, 19 26.	Skull No. 3 or 13 *b*.	Skull No. 14.
1. Length breadth	66·02	66·20	76·73?	85·37
2. Length height index	70·68	75·24	73·68?	72·26
3. Length auricular	62·03	64·01	66·48?	60·98
4. Breadth height index	107·25	112·61	96·03?	84·64
5. Index of the occipital foramen	68·48	76·47	—	82·35
6. Total facial index	88·98?	105·85	—	—
7. Superior facial index	53·93?	—	52·86?	—
8. Orbital index	84·46	88·47	98·68	89·85
9. Nasal index	51·06?	48·21	49·06	48·60
10. Maxillo-alveolar index	126·04	110·74	138·49	—
11. Palatal index	89·36	80·37	95·92	109·68
12. Ramus index	61·62	68·08	62·65	—
13. External auditory meatus position index	48·26	52·34	56·21	53·16
14. Bregma position index	29·37	32·38	40·82	33·54
15. Facial profile angle	79°	82°	82°	87°

TABLE V.—MEASUREMENTS ON CRANIOGRAMS

	♀ Skull 1	♂ Skull 2	♂ Skull 3 (13 *b*)	♂ Skull 6	♀ Skull 7	♂ Skull 8	♀ Skull 10	♂ Skull 11	Infant Skull 14	♀ Skull 19	♂ Skull M
Nasion inion line	166	189	169	176	172	170	180	184	158	183	191
Nasion to foot of meatal perpendicular	92	85	95	99	70	72	105	87	84	99	100
Nasion to foot of bregma perpendicular	58	—	69	66	58	69	52	57	53	54	54
Calvarial height	93	92	96	108	98	88	103	114	98	102	112
Auditory meatus position index	55·42	44·97	56·21	56·25	40·69	42·35	58·33	47·28	53·16	54·1	52·36
Bregma position index	34·94	—	40·82	37·5	33·72	40·58	28·8	30·98	33·54	29·5	27·77
Facial profile angle	90°	78°	82°	81°	82°	79°	83°	80°	87°	82°	—
Frontal inclination angle	61°	—	55°	55°	57°	58°	60°	60°	61°	58°	62°
Occipital inclination angle	100°	87°	76°	—	84°	78°	88°	86°	82°	85°	86°
Calvarial base angle	10°	11°	8°	12°	—	15°	30°	14°	17°	9°	—
Calvarial height index	56·02	48·67	56·86	61·36	56·97	51·76	57·2	47·28	62·02	55·73	58·63

TABLE VI.—FACIAL MEASUREMENTS IN AN ANTERO-POSTERIOR PLANE

Skull No.	Pre-auricular length.	Basi-nasal length.	Projection of lateral orbital margin in front of mid-auricular plane.	Projection of nasion.	Projection of ascending nasal process of maxilla.	Projection of lateral nasal margin.	Projection of sub-nasal point.	Projection of upper alveolar point.	Projection of lower alveolar point.	Projection of meatal point.	Projection of malo-maxillary point.	Projection of the nose.
Skull 1	91	98	65·5	88	93	85	89	89	82	83	64	26
Skull 2	86	—	73	79	—	—	—	—	—	—	71	—
Skull 3 (13 *b*)	93	—	67·5	91	89	84·5	—	96	92	93·5	65	—
Skull 6	97·5	103·5	69·5	95	99·5	91	95	98	92·5	93·5	—	24
Skull 7	74	75	62	69	—	—	69·5	73	—	—	—	—
Skull 8	80	84	51	75	76·5	69	—	76	73	69·5	52	19·5
Skull 10	100	107	57	98	99	92	101	103	—	—	66	33·5
Skull 11	90	90·5	66·5	82	—	83	88	89·5	89·5	90·5	75	15
Skull 14	81	—	61	78	—	—	—	—	—	—	61	—
Skull 19	99	105	69·5	96	101	97	97	100·5	89	84	71	28·5
Nāl I	89	—	64·5	85	86·5	80	—	86·5	—	—	—	—

TABLE VII.—MEASUREMENTS SHOWING THE PROJECTION OF THE CHEEK IN AN ANTERO-POSTERIOR PLANE [1]

Skull No.	A	B	C	D	E	F
Skull 1	74·5	67	74	67·5	42·5	21
Skull 2	80·5	75·5	85	75	55	29·5
Skull 3 (13 *b*)	78·5	70·5	77·5	67·5	50	26·5
Skull 6	78·5	71·5	81·5	—	—	—
Skull 7	69	63·5	68	60	40	21
Skull 8	63	57	67	59	38	21
Skull 10	65	59·5	74	68	43	22
Skull 11	76	70	79	76·5	49·5	22·5
Skull 14	68	63·5	68	60	40	21
Skull 19	79·5	71·5	81	72	41	20
Nāl I	71	66·5	75	64	45	29

[1] Sir Arthur Keith, "Ancient Cemeteries of the Tarim Basin": *JRAS*. vol. lix, p. 167, 1929. Letters used in this table are the same as those used by Keith.

CHAPTER XXXI

ZOOLOGICAL REMAINS

SO far as I am aware, this is the first occasion on which a thorough investigation of the animal remains obtained by archæological excavation in India has been carried out, and it is therefore of no small interest to see to what extent such investigation can furnish data regarding the conditions in which the early inhabitants of these sites lived, and whether by means of such a study we can confirm or refute conclusions regarding these early peoples that have been drawn from other lines of evidence.

GENERAL CONDITION OF THE ANIMAL REMAINS

In almost every instance the animal remains that I have examined are extremely fragile, as was only to be expected from the length of time that has elapsed since Mohenjo-daro was a flourishing city. In most of the specimens the organic material of the bone has completely disappeared, and all that is left are the calcium and other salts ; owing to the nature of the soil in which the remains have been buried, many of the bones are impregnated with a deposit of gypsum, and small patches of the same material are common on the exposed surfaces. A curious fact that seems to me to be worthy of special mention is that bones that had been burnt or charred with fire are very much better preserved than those that have not undergone this process. In most instances the animal remains are very fragmentary in character. In not a single instance has a long bone, such as the femur, humerus, or tibia, of a large animal been recovered intact ; smaller bones, such as the carpal or meta-carpal bones and the phalanges, are complete in quite a number of cases, and, as a rule, the teeth are comparatively well preserved, though it was rare to get even a small portion of the jaw to which they belonged.

The general characters of the bones clearly resemble those of the collections made at Anau. Duerst,[1] describing this latter collection, remarks : " The greater part of the bones have a yellow-brown colour," and the same is equally true of the present series. In both series all the long bones have been broken, but the smaller bones of the extremities have escaped this fate. Duerst (loc. cit., p. 343) also points out that " among the sheep and pigs, there is a great quantity of bones of very young animals ", and the same holds good of the Mohenjo-daro collection. In the case of the cattle also the epiphyses of the vertebra had, in several instances, not fused with the centrum, and many of the teeth were also unworn, indicating that the animal from which they came was young and had probably been killed for food.

[1] Duerst, " Animal Remains from the Excavations at Anau " in *Explorations in Turkestan*, Prehistoric Civilization of Anau, ed. by R. Pumpelly, pt. vi, Washington, 1908.

The Number of Species represented in the Collection

In all, I have been able to identify without any doubt no less than thirty-seven, or if we include the Polyzoan and Sponge, growing on the mollusc *Fasciolaria*, and the Anatinid mollusc living in the coral, thirty-nine different species of animals in the collection. Several of these are, of course, domestic or semi-domestic animals, such as one would expect to be associated with a people that had reached so high a stage of civilization as that exhibited by the inhabitants of Mohenjo-daro ; others, however, are wild animals that probably inhabited that part of the country either at the time when Mohenjo-daro was a flourishing city or at some later period when the city had been destroyed. In arriving at any conclusion as to the time or period when these animals lived, one has to rely in the main on the depth at which these remains have been discovered, but it must be recognized that this is not always a reliable criterion, since it is possible that in times past the inhabitants of the country or of the city itself may have buried their refuse, which would naturally include such things as the bones of animals that had been slaughtered for food or had been killed as vermin. In such cases the remains would naturally be found at a somewhat lower level than that to which they properly correspond.

I have given below a list of the various remains that I have been able to identify, with the depths at which they were found ; and I have in the main followed the classification that has been adopted in the various volumes of the *Fauna of British India* series.

Class *MAMMALIA*

Order CARNIVORA

Family VIVERRIDÆ

Sub-family Herpestinæ

Herpestes auropunctatus, the small Indian Mongoose

HR 2119, depth 5 ft. below surface. One skull, almost complete. The skull had been completely burnt.

This species is widely distributed throughout Northern India, including Sind, and extends westward through Balūchistān, South Afghānistān, and Southern Persia. The western variety, described by Blyth as *H. pallipes* and by Gray as *H. persicus*, is paler and more grey in colour than the type form. In Pl. CLXIII, Figs. 5 and 7, I have given photographs of this skull from above and from the side, and for comparison (Figs. 6 and 8) the same views of the skull of an example of *H. auropunctatus* from the collections of the Zoological Survey of India. There are a few minor points of difference between the two skulls, but a study of the available material indicates that these are probably merely a question of age.

Family CANIDÆ

Canis familiaris

DM 273, depth 1 ft. 10 in.	Part of a skull, including the hard palate and two teeth.
	Posterior part of left mandible.
	Part of right maxilla.
	Part of right maxilla (of a second individual).
	Part of left maxilla.
	Horizontal ramus of right mandible.
	Horizontal ramus of left mandible.
	Horizontal ramus of right mandible (of a second individual).
HR 5706, depth 5 ft. 3 in.	Fragment of lower jaw, including coronoid and articular processes.

Both the skull and jaws undoubtedly belong to a species of dog, and probably both come from the same species. The fragment of lower jaw, HR 5706, shows clear points of difference from the wild dog, *Cyon dukhunensis*, in that the coronoid process of the jaw springs at an oblique angle from the horizontal ramus, instead of being almost at right-angles to it, as in the case of the wild dog. We can, therefore, I think, exclude this wild species from further consideration ; it seems certain that the remains are those of one of the domestic or semi-domestic dogs that are so common at the present day around every Indian village, and at the present time live around the site of the excavations. Duerst,[1] in his account of the animal remains excavated at Anau in Turkestān, has considered in detail the characteristics and probable phylogenetic origin of the dog from that locality, and it is very interesting to compare the Anau remains with those excavated at Mohenjo-daro. Duerst (loc. cit., p. 349) states that the Anau dog "has a very strongly marked resemblance to the European shepherd-dog, especially in the facial part", but that it posssessed a slightly less-pointed snout and a wider palate, points of difference that might, however, be attributable to sex. He further points out that the Anau dog stands craniologically very near to the dingo and to a dog the remains of which were found at Bologoa in Russia and are attributed to the late Palæolithic period. The Russian dog was described by Studer[2] under the name *Canis poutiatini*. As regards the origin of the Anau dog, Duerst advances two theories, either of which would fit the known facts : (1) the theory first advanced by Studer, that the shepherd-dog was derived from the Russian *Canis poutiatini*, or (2) that the dingo must have lived in Southern Asia, and that from it both the pariah-dog and the shepherd-dog have descended.

In the table on p. 652 I have given a series of measurements taken on the remains of the Mohenjo-daro dog, and for the purpose of comparison I have given the same measurements in the Anau dog (from Duerst, loc. cit.), in *Canis poutiatini* (from Studer, loc. cit.), in two specimens of the true dingo dog from Australia, now in the collections of the Zoological Survey of India, and in three Indian pariah-dogs from the collection of the Biological Department Medical College, Calcutta, lent to me by Professor Ekendranath Ghosh, to whom my thanks are due. Duerst (loc. cit., 1908, p. 346) appears to regard the dental formula in the upper jaw as 3.1.3.3. In the following account I have followed the formula as given by Reynolds[3] for the Canidæ, namely $\frac{3.1.4.2}{3.1.4.3}$.

From the measurements given in the Table it is abundantly clear that the Mohenjo-daro dog comes extremely close to the Anau dog, and that both are very nearly related to, if not actually identical with, the palæolithic *Canis poutiatini*, on the one hand, and the present day *Canis familiaris* var. *dingo* on the other. Such differences as do exist between the various series of measurements are very slight ; the Anau dog seems to be, for its size, slightly wider in the muzzle, but the measurement falls within the limits exhibited by the other examples and is no wider than the muzzle of examples of *Canis familiaris* var. *dingo* from both Australia and India ; and the differences between the whole series of examples may quite well be due either to differences of sex or age. It would, therefore, appear to be probable that the Anau and Mohenjo-daro dogs, on the one hand, and the dingo dog of Australia and the Indian pariah on the other, possessed a common ancestry that can be traced back to the palæolithic *Canis poutiatini* of Russia.

[1] Duerst, "Animal Remains from the Excavations at Anau": *Explorations in Turkestan*, Expedition of 1904, vol. ii, ed. by R. Pumpelly, Washington, 1908.

[2] Studer, "Über einen Hund aus der Palæolithischen Zeit Russlands. Canis Poutiatini": *Zool. Anzeiger*, vol. xxix, Leipzig, 1908.

[3] S. H. Reynolds, *The Vertebrate Skeleton*, Cambridge.

TABLE I.—DIMENSIONS IN MM. OF THE SKULL, ETC., OF THE MOHENJO-DARO DOG

	Mohenjo-daro Dog.					Anau dog.	*Canis poutiatini* Studer.	*Canis familiaris*, var. *dingo* Australia.		Indian Pariah.			
	I	II	III	IV	V			I	II	I	II	III	IV
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Width of muzzle before front premolar	35	—	—	—	—	41	—	33·0	41·0	35·0	34·0	41	36·0
Width of muzzle in front of premolar 2	33·5	—	—	—	—	—	31·0	33·5	41·5	34·0	33·5	40·0	34·0
Width of palate	46·0	—	—	—	—	50	45·5	50·0	59	48·0	47·5	57·0	47·0
Height of snout at ant. end of nasal bones	24·0?	—	—	—	—	—	25·0	23·0	27·5	23·0	24·0	32·0	22·0
Length of nasals	62·0	—	—	—	—	—	72·0	66·5	82	71·5	70·5	85·0	66·0
Width of nasals	17·0	—	—	—	—	—	17·0	16·5	21·0	17·0	17·0	25·0	17·0
Length of teeth (premolars and molars)	61 [1]	—	—	—	—	69	65·0	62·0	66·5	64·0	64·0	75·0	62·5
Length of carnassial tooth	17·5	16·0	17·0	17·0	—	17	18·0	19·0	17·5 [2]	18·5	19·0	19·5	19·5
Breadth of carnassial tooth	10·0	8·75	9·5	9·5	—	9	11·0	10·0	11·0 [2]	8·5	10·5	11·5	10·0
Length of molar 1	11·5	—	12·0	—	—	—	11·0	12·5	11·5 [2]	12·0	—	14·0	14·0
Breadth of molar 1	15·0	—	14·0	—	—	—	15·0	16·5	16·0 [2]	15·0	—	16·5	15·0
LOWER JAW.													
Height of vertical ramus	53?	—	—	—	—	57?	54	54·0	65·0	—	—	—	50·0
Height of horizontal ramus opposite molar 1	23·0	—	—	—	26·5	25	23·0	23·5	27·5	—	—	—	21·0
Length of molar 1	18·5	—	—	—	20·0	—	—	—	—	—	—	—	21·5
Breadth of molar 1	8·0	—	—	—	8·0	—	—	—	—	—	—	—	9·0
Length of molar 2	9·5	10·0	10·5	9·5	9·5	—	9·0	8·5	9·0 [2]	—	—	—	10·0

Family SORICIDÆ

Crocidura bidiana = *Pachyura stoliczkana*

VS 207, depth 2 ft. One skull complete except for the tympanic bullæ, and the anterior part of a second.

Both the skulls appear to belong to the same species. In both, the character of the dentition is identical; there is a small tubercle inside the basal cusp of each anterior upper incisor tooth; the second incisor is considerably larger than the third, which is, in turn, about equal to the canine; and there is a well-developed gap between the canine and the second premolar, in which almost the whole of the first premolar tooth is visible from the outside. The specific determination of the modern shrews is, in the present state of our knowledge, almost impossible without a great deal of further research. All that one can do, with any certainty, is to refer individuals to certain groups, and there seems little doubt that the specimens belong to the *bidiana* (= *stoliczkana*) group. These little shrews are nocturnal in habit, and at the present day commonly frequent houses in search of insects. In Pl. CLXIII, Figs. 1 and 3, I have given photographs of the better preserved of these two skulls, and for the purpose of comparison I also give corresponding views (Figs. 2 and 4) of a skull of *Crocidura bidiana* from the collections of the Zoological Survey of India.

[1] This measurement is the length between the extremes of the teeth sockets; the teeth themselves are missing, and at least 1 mm. should be added to give the true teeth measurement.

[2] These teeth are badly worn down, and the measurements are therefore probably too low.

Order RODENTIA

SIMPLICIDENTATA

Family MURIDÆ

Mus rattus = *Rattus rattus*, The Black Rat

VS 125, depth 4 ft. 3 in. Portion of the left half of the mandible including the teeth.

Both in size and in the character of the teeth this fragment corresponds with the common rat.

Order UNGULATA

SUBUNGULATA

Family ELEPHANTIDÆ

Elephas maximus, The Indian Elephant

DK 1212, depth 6 ft.	The upper articular surface or caput of the femur.
Trial Trench, depth 6 ft.	Tip of small tusk.
SD 1683, depth 3 ft.	Tips of small tusks (two).

Although these are the only fragments so far obtained of any bony remains of this animal, pieces of ivory are common, and in at least one case a large fragment of a tusk has been excavated at Mohenjo-daro. That the inhabitants were perfectly well acquainted with the elephant there can be no doubt, but the actual finding of a part of the skeleton, as opposed to the presence merely of ivory, is sufficient to show that the animal actually lived in this region, either in the wild state or as a domestic animal, probably the latter. At the present day, wild elephants are still found along the base of the Himālayas, but formerly their range was more extensive ; even as late as A.D. 1600 the elephant was found in the wild state in Mālwā and Nimār, and up to the latter half of last century in the Chānda District of the Central Provinces.

UNGULATA VERA

Sub-order *PERISSODACTYLA*

Family EQUIDÆ

Equus caballus, The Horse (Pl. CLXII, Fig. 9)

DM 293, depth 1 ft. 10 in. A large fragment of the right half of the mandible, containing the premolar and molar teeth ; and a second fragment containing the same teeth of the left side.

In size the fragment of jaw corresponds exactly to that of a skull of a modern horse in the collection of the Zoological Survey of India. Duerst,[1] in his detailed analysis of the remains of the horse of Anau, has given a Table of Measurements of the dimensions of the teeth in the lower jaw, and it is interesting to compare the present specimen with the details given by him. For the purpose of comparison I have also given the dimensions of the teeth in a skull of *Equus caballus* in the Indian Museum.

[1] Loc. cit., p. 389.

		Mohenjo-daro Horse.		Anau Horse.		*Equus caballus* in the Zoological Survey of India.	
		R. mm.	L. mm.	R. mm.	L. mm.	R. mm.	L. mm.
Premolar 2	Length	34·5	32·5	32·0	—	33·5	32·0
	Breadth	18·0	20·0	15·0	—	19·0	19·0
Premolar 3	Length	28·0	29·0	27·0	26·0	27·0	26·0
	Breadth	21·0	21·0	17·5	20·0	22·0	21·0
Premolar 4	Length	27·0	27·0	—	25·0	27·0	26·0
	Breadth	21·0	21·0	—	14·0	21·5	22·0
Molar 1	Length	25·0	25·0	—	23·0	25·0	24·5
	Breadth	18·5	19·0	—	16·0	19·5	19·5
Molar 2	Length	25·0	25·0	—	24·0	26·0	25·0
	Breadth	17·5	18·0	—	14·0	19·0	19·0
Molar 3	Length	30·5	30·5	—	—	31·5	31·5
	Breadth	16·0	15·5	—	—	15·5	16·0

It will be seen that there is a considerable degree of similarity between these various examples, and it is probable that the Anau horse, the Mohenjo-daro horse, and the example of *Equus caballus* of the Zoological Survey of India, are all of the type of the Indian "country-bred", a small breed of horse, the Anau horse being slightly smaller than the others.

PECORA

Family BOVIDÆ

Bos indicus, The Humped Cattle

Trial trench, depth 6 ft.	3rd molar tooth of the right lower jaw.
„ „	3rd molar tooth of the left lower jaw.
„ „	3rd molar tooth of the left upper jaw.
DK 347, depth 4 ft.	3rd molar tooth of the left lower jaw.
DK 1170, depth 17 ft.	3rd premolar tooth of the right upper jaw.
DK 2410, depth 4 ft.	3rd molar tooth of the right lower jaw.
VS 342, depth 9 ft. 6 in.	2nd molar tooth of the left upper jaw.
HR 5075, depth 6 ft.	3rd molar tooth of the right lower jaw.
HR 4211, depth 6 ft.	1st premolar tooth of the right upper jaw.
SD 1811, depth 3 ft.	part of 3rd molar of the right lower jaw.
SD 136, depth 4 ft.	2nd premolar tooth of the left upper jaw.
„ „	2nd incisor tooth of the right lower jaw.
SD 800, depth 6 ft.	1st molar tooth of the right upper jaw.
SD 922, depth 9 ft.	1st premolar tooth of the left upper jaw.
SD 1159, depth 12 ft.	1st premolar tooth of the left upper jaw.
VS 3655, depth 6 ft.	3rd molar tooth of the right upper jaw.
VS 469, depth 10 ft.	Metatarsal and tarsal bones.
SD 1586, depth 15–16 ft.	Metatarsals, 1st and 2nd molar teeth of right upper jaw.
DK 820, depth 5 ft. 9 in.	1st premolar tooth of right lower jaw and 1st and 2nd molar teeth of left lower jaw.
DK 635, depth 6 ft. 10 in.	3rd molar tooth of left upper jaw.
VS 2331, depth 4 ft. 2 in.	Condyle of lower jaw and part of ramus.
DK 2640, depth 15 ft.	Left horn of *Bos* sp.
SD 906, depth 3 ft.	Frontal region of skull.

The great majority of the remains of cattle found at Mohenjo-daro consist of isolated teeth. Duerst (*vide* Pumpelly, 1908, p. 363) remarks in his report on the animal remains excavated at Anau, that among the Taurina proper and the Prototaurina the teeth offer an easy means of discrimination : he quotes Rutemeyer (*Versuch einer Natürlichen Geschichte des Rindes*, Abt. 1, p. 91), who states that "Bison and Yak have become so sharply characterized that their teeth can be distinguished from those of Taurus, Bubalus, and of the Bibovina (Protaurus *mihi*), through the weakest development of the accessory collums".
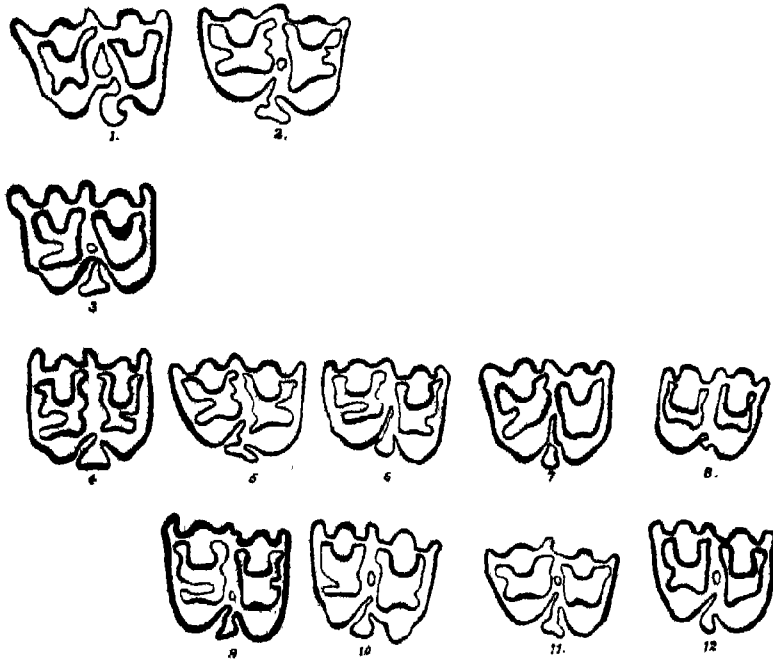
FIG. 37.—The grinding surface of the 3rd Molar Tooth (upper jaw) in various species of cattle.

Bos bubalus : 1, Recent ; 2, Mohenjo-daro.
Bos frontalis : 3, Recent.
Bos indicus : (slight wear) 4, Nicobars ; 5–6, Mohenjo-daro ; 7, Nicobars ; 8, Bengal.
" " (moderate wear) 9, 11, Mohenjo-daro ; 10, Nicobars ; 12, Bengal.

A study of the various skulls of cattle in the collection of the Indian Museum has shown that there is a very considerable degree of variation in the characters of the teeth, even within the limits of a single species ; much of this variation is, doubtless, due to differences of age and sex, but I do not think that the whole of it can be attributed to these causes ; and, until we know the limits within which teeth may vary in any one species, it is only with some degree of doubt that one can refer isolated teeth, such as form the greater part of the Mohenjo-daro collection, to any particular species. In the present series of teeth the general characters indicate that they belong to an animal of the Taurine group, and from a comparison with the teeth in the Indian Museum collection of skulls it seems probable that they are referable to *Bos indicus*, the humped cattle. Even within the limits of this species there are considerable variations in the characters of the teeth, and especially in the complexity

of the foldings of the enamel bands. In many parts of India herds of these cattle have run wild, and in the Indian Museum collection are three skulls belonging to the wild cattle from Canorta Island in the Central group of the Nicobar Islands. The history of this, now wild, herd is well known; they are the descendants of the domestic cattle that were left behind when the Penal settlement on Canorta was abandoned some sixty years ago. I have myself seen these herds on many occasions, and I can say without any hesitation that they have improved enormously as a result of the abundance of open grassland and a copious food-supply; and associated with this improvement in their general character there has been a change in the character of the teeth.

Fig. 38.—The grinding surface of the 2nd Molar Tooth (upper jaw) in (1) example from Mohenjo-daro, (2) in wild cattle from the Nicobar Islands, and (3) recent domestic cattle of Bengal.
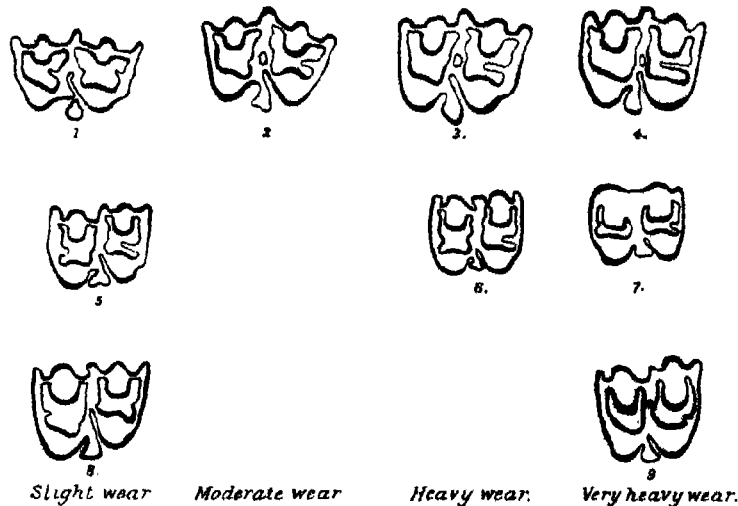
Fig. 39.—Showing the enamel foldings at different stages of wear in the same tooth.

In Text-figures 37 and 38 I have given outline drawings of the grinding surface of teeth belonging to the Mohenjo-daro cattle, the wild cattle of the Nicobars, and present-day domesticated cattle from Bengal. A comparison of the two series of teeth, slightly worn and moderately worn, shows that there is a great resemblance between the teeth of the wild cattle and those from Mohenjo-daro, whereas the teeth from the domesticated cattle of Bengal show a considerable simplification in the foldings of the enamel bands. This simplification in the folding of the enamel bands in the teeth of the domesticated cattle of Bengal is clearly shown at all levels in the teeth, and in Text-figure 39 I have given for comparison a series of

sections *through the same tooth* in examples from Mohenjo-daro, the Nicobars, and Bengal. In the first series from Mohenjo-daro (Nos. 1 to 4) it can be seen that the folding of the enamel bands tends, if anything, to become more complicated as we proceed from the surface to the root of the tooth; in the cattle from the Nicobars (Nos. 5 to 7) there is but little change; whereas in the domesticated cattle from Bengal (Nos. 8, 9) there is an equally distinct tendency for the enamel bands to become more simple as the tooth gets worn down towards the roots. We thus get a progressive series commencing with the Mohenjo-daro cattle and passing through the wild cattle to the present-day domesticated cattle. This change I attribute to a steady and progressive deterioration in the cattle, and correlated with this deterioration there is a change in the actual size of the teeth themselves; in the following Table I have given measurements of teeth from the three series of cattle.

TABLE II.—SHOWING THE MEASUREMENTS IN MM. OF THE LENGTH AND BREADTH OF THE 2ND AND 3RD MOLAR TEETH IN DIFFERENT SERIES OF *Bos indicus*

	Molar 2.		Molar 3.	
	Length.	Breadth.	Length.	Breadth.
	mm.	mm.	mm.	mm.
	Cattle from Mohenjo-daro			
	27·5	21·5	31·0	24·0
	28·5	24·0	30·0	22·0
	28·5	20·0	30·5	23·0
	—	—	31·0	19·5
	—	—	30·5	23·0
	—	—	31·5	21·5
	—	—	30·0	20·5
Average size	28·17	21·83	30·64	21·93
	Wild Cattle from Nicobars			
	25·0	20·5	29·0	21·5
	25·5	20·0	29·0	21·25
	27·0	21·5	29·0	23·5
	27·0	22·0	29·5	23·0
	27·0	21·0	28·5	21·0
	26·5	20·5	28·0	20·0
Average size	26·33	20·92	28·83	21·75
	Domestic Cattle of Bengal			
	25·5	21·0	29·0	21·5
	25·0	23·0	28·5	22·0
	25·0	23·0	25·5	22·0
	26·5	19·5	26·0	21·5
	26·5	18·0	27·5	20·5
	21·0	20·5	26·5	21·0
	21·0	21·5	—	—
Average size	24·36	21·07	27·17	21·42

A comparison of the measurements given in the above table shows clearly that there has been a reduction in the actual size of the teeth; those from Mohenjo-daro are the largest, while the teeth of domestic cattle of the present day from Bengal are the smallest, the wild cattle from the Nicobars being intermediate.

In addition to the cattle teeth in the Mohenjo-daro collection, there is a large fragment of the frontal region of a skull and a single right horn-core that show an extremely close resemblance to the corresponding parts of a recent skull of *Bos indicus* (*vide* Pl. CLXII, Figs. 1–3). The presence of granular ridges at the base of the latter indicate that the animal from which it came was an adult. Both these fragments agree closely with *Bos indicus*, but here again there is evidence that the Mohenjo-daro cattle were larger than they are at the present time. In the following table I have given the measurements of these two fragments and the corresponding measurements in skulls of the wild Nicobar cattle and the present-day domestic cattle of Bengal.

TABLE III.—GIVING CERTAIN MEASUREMENTS OF THE SKULL AND HORN-CORE IN *Bos indicus*

	Mohenjo-daro.	Nicobar Islands.		Bengal.
	mm.	mm.	mm.	mm.
Width between orbital margins	162·0	158·5	152·0	143·0
Least width across the forehead	167·5	164·0	161·0	158·0
Distance between the frontal foramina	117·0	97·5	97·0	97·0
Length of horn-core along the curve	240	220	185	182
Diameter at base of horn-core	66	67·5	67	56
Circumference at base of horn-core	198	198	196	167
Width of condyle of lower jaw	48·5	43·0	40·0	—

Duerst, in his account of the cattle remains from Anau, remarks : "It seems very probable, therefore, that the higher layers contained a smaller breed of cattle, which was formed there by the physiographical influence on the climate and on the production of food during the period of aridity at the end of culture period I ; or which came into Anau at the same time as the camel, the goat, the hornless sheep, and the shepherd-dog."

The original wild cattle of Europe were larger than the modern domesticated races, and Hodgson also remarks, regarding the Indian Buffalo, that the wild animals are fully a third larger than the largest tame breeds in India. This same reduction in size appears to hold good with *Bos indicus*, whether the early examples that we have examined from Mohenjo-daro were wild or domesticated.

Blyth,[1] in a paper on the Flat-horned Taurine Cattle of South-east Asia, remarks : "The humped cattle are unknown in an aboriginally wild state ; and I am strongly of opinion that they will prove to be of African rather than of Asiatic origin, however ancient their introduction into India ; for no fossil or semi-fossil remains of this very distinct type have as yet been discovered in any part of Asia, where the only established fossil Taurine is the *Bos namadicus* of the Nerbudda deposits, which is barely (if at all satisfactorily) distinguishable from the European *Bos primogenius* (or true *Urus* of Cæsar)."

The humped cattle were well known to the ancient Egyptians, but at present we have no evidence of the time of their first appearance in this country ; Blyth (loc. cit.) quotes a note by Cowell to the effect that the earliest reference to this animal in Indian literature is to be found in the tenth book of the Rig Veda, which he places at 900–1000 B.C. ; but the finding of the remains at Mohenjo-daro antedated this by about 2,000 years. It seems possible that these cattle were introduced into India from the west by some immigrating offshoot of the Mediterranean race that spread eastwards across Babylonia and Sumer.

[1] Ed. Blyth, "On the Flat-horned Taurine Cattle of S.E. Asia" : *JASB*. vol. xxix, p. 282, Calcutta, 1860.

Bos bubalus = *Bubalis bubalis*, The Buffalo

HR 2974, depth 3 ft.	3rd molar tooth of the right upper jaw.
HR 3043, depth 4 ft. 6 in.	1st molar tooth.
SD 2581, depth ?	Calcaneum.
SD 2250, depth 4 ft.	Lower portions of left humerus.
VS 2331, depth 4 ft. 2 in.	Portions of lower jaw: (1) with molar 3 of left side; (2) molars 2 and 3 of right side; and (3) premolar 2 and 3 and molar 1 of left side (probably of same animal).
DM 10, depth 4 ft. 5 in.	Molar 2 of left lower jaw; molar 3 of right lower jaw.

These remains do not appear to differ appreciably from those of the modern buffalo, though a comparison of the foldings of the enamel in the teeth from Mohenjo-daro and those of recent domestic animals in Bengal indicates the possibility that there has been some degree of simplification in these latter races (*vide* Text-fig. 37, Figs. 1 and 2).

Ovis sp.

Trial trench, depth 6 ft.	3rd molar tooth of the right lower jaw.
HR 2852, depth 3 ft.	2nd and 3rd molar teeth, right lower jaw.
HR 3235, depth 2 ft. 6 in.	Part of right mandible (burnt).
SD 108, depth 3 ft. 4 in.	3rd molar tooth of the left lower jaw.
VS 128, depth 1 ft. 2 in.	1st and 2nd molar teeth, right lower jaw.

Family CERVIDÆ

Sub-family CERVINÆ

Cervus cashmerianus, The Kashmīr Stag

HR 27, depth surface.	Part of right antler.
VS 2831, depth 8 ft.	Part of right antler of young specimen. Shed.

Cervus unicolor. *Rusa unicolor*, The Sambar or Rusa Deer

HR 27, depth surface.	Portion of antler of adult.
DM 55, depth 4 ft. 6 in.	Part of horn in "velvet".
DK 2133, depth 2 ft.	Part of horn in "velvet".
VS 3059, depth 8 ft. 2 in.	Part of antler.
SD 1297, depth 3 ft. 6 in.	Antler. Shed.
SD 1683, depth 3 ft.	Part of antler of a young specimen.
SD 1443, depth 5 ft.	Base of antler. Shed.
DK 578, depth 2 ft. 6 in.	Portion of antler.
C 517, depth 7 ft.	Portion of antler.
SD 696, depth 4 ft.	Portion of antler.
SD 1473, depth 3 ft.	Fragment of antler.
DK 990, depth 3 ft.	Portion of Sambar horn.
DK 1252, depth 6 ft. 9 in.	Portion of Sambar horn.
DK 2724, depth 3 ft.	Portion of Sambar horn.
DK 4630, 12·3 ft. B.D.	Portions of two Sambar horns.
DK 4631, 12·1 ft. B.D.	
DK 4632, 11·0 ft. B.D.	
DK 4616, 12·18 ft. B.D.	Fragment of Sambar horn.

Specimen SD 1297 possessed a circumference measurement of 5·5 inches, and from the fragments labelled DK 4630, 4631, and 4632 I have been able to reconstruct the basal parts of two other antlers; these give the following measurements:—

(*a*) Circumference of base 6·25 in.
(*b*) Circumference of base 5 in.

This measurement is taken round the shaft immediately above the brow-tine and compares very favourably with the size of horns of the present-day examples in the collection of the Indian Museum, among which there are the following :—

1 example of 10 in. circumference.
2 examples of over 7 in. and under 8 in. circumference.
21 ,, ,, ,, 6 in. ,, ,, 7 in. ,,
14 ,, ,, 5 in. and over, but under 6 in. circumference.
13 ,, ,, under 5 in. circumference.

In most cases in which the basal part of the antler is preserved, it is clear that the horns had been shed naturally.

Cervus axis = *Axis axis*, The Spotted Deer

SD 2608, depth 4 ft. Base of antler. Shed.

Cervus porcinus, The Hog-Deer

Trial trench, depth 6 ft.	Part of antler.
VS 2898, depth 8 ft.	Part of antler.
SD 502, depth 5 ft.	Base of antler. Sawn off through pedicle.
SD 1852, depth 10 ft.	Tip of antler.
VS 200, depth ?	Base of antler. Shed.
B 712, depth 6 ft.	Base of antler. Cut off through pedicle.

Specimen B 712 gave a measurement of the circumference of the horn above the first tine of 3 inches. Among the series in the Indian Museum are eight examples having a circumference of 3 inches or over, and fourteen examples in which the circumference falls between 2½ and 3 inches.

TYLOPODA

Family CAMELIDÆ

Camelus dromedarius ?

SD 1386, depth 15 ft. Lower portion, including the glenoid fossa, of left scapula.

A comparison of this fragment with the corresponding portion of the skeleton of a recent camel in the collection of the Zoological Survey of India leaves no doubt as to its identity. It is interesting to note that up to the present time this is the only example of any remains of this animal, so common at the present time throughout Sind.

SUINA

Family SUIDÆ

Sus cristatus, The Indian Boar

Trial trench, depth 6 ft.	Portion of right lower tush.
,, ,,	1st incisor of right lower jaw.
,, ,,	4th premolar of left lower jaw.
,, ,,	2nd molar of left lower jaw.
,, ,,	2nd molar of right lower jaw.
,, ,,	3rd molar of right lower jaw.
,, ,,	3rd molar of right upper jaw.

Trial trench, depth 6 ft.	3rd molar of left lower jaw.
" "	Tip of left upper tush.
C 3314, depth 1 ft. 6 in.	Part of left lower jaw with 3rd and 4th premolar teeth.
DK 289, depth 2 ft. 6 in.	Part of left upper jaw with premolars 3, 4, and molars 1, 2.
DK 1170, depth 17 ft.	3rd molar of right lower jaw.
DK 1170, depth 17 ft.	3rd molar of left lower jaw.
DK 1530, depth 3 ft.	3rd molar of right upper jaw.
DK 1957, depth 10 ft.	1st molar of left upper jaw.
DK 2410, depth 4 ft.	3rd molar of left upper jaw.
DM 24, trench B, depth 7 ft.	3rd molar of right lower jaw.
HR 3056, depth 3 ft. 9 in.	2nd molar of left upper jaw.
HR 5573, depth 3 ft. 4 in.	Part of 3rd right molar of upper jaw.
SD, trench F, depth 3 ft.	3rd molar of left upper jaw.
SD 368, depth 6 ft.	Part of right lower jaw with molars 1, 2, and 3.
SD 368, depth 6 ft.	Part of right upper jaw with premolars 3 and 4.
SD 502, depth 4 ft.	3rd molar of right lower jaw.
SD 621, depth 5 ft.	2nd molar of left lower jaw.
SD 621, depth 5 ft.	2nd molar of right upper jaw.
SD 800, depth 6 ft.	3rd molar of left lower jaw.
SD 905, depth 8 ft.	3rd molar of right lower jaw.
SD 1190, depth 7 ft.	Part of left lower jaw with premolars 2, 3, and 4 and molars 1, 2, and 3.
SD 1589, depth 16 ft.	1st incisor of right upper jaw (two examples).
SD 1659, depth 3 ft.	Part of left upper jaw with molars 2 and 3.
SD 1683, depth 3 ft.	Tip of tush of left upper jaw.
SD 1683, depth 3 ft.	1st incisor of left lower jaw.
SD 2135, depth 13 ft.	1st and 2nd molars of left upper jaw.
SD 2294, depth 1 ft.	1st molar of left upper jaw.
SD 2586, depth 1 ft.	Tip of tush of right lower jaw.
VS 3256, depth 2 ft.	1st molar of left upper jaw.
VS 3654, depth 6 ft.	Tip of tush of left lower jaw.
DM 13, depth 2–4 ft.	Part of left lower jaw with premolars 1–4.
HR 5250, depth 2 ft.	Molar 3 of right upper jaw and part of maxilla.
VS 2331, depth 4 ft. 2 in.	Part of left lower jaw with molars 1 and 2.
DK 635, depth 6 ft. 10 in.	Molar 2 of lower jaw.
SD 929, depth 8 ft. 10 in.	Part of lower jaw with molars 2 and 3.
DM 112, depth 5–7 ft.	Incisor 3.
B 595, depth 15 ft. 6 in.	Incisor 2 of left upper jaw.
DK 820, depth 5 ft. 9 in.	Molar 3.
SD 1586, depth 15–16 ft.	(*a*) Part of right upper jaw with premolar 4 and molars 1–3 (calcined).
	(*b*) Molar 3 (calcined).

As the above list of finds shows, the remains of pigs are of comparatively common occurrence and have been obtained down to a depth of 17 feet. Blanford (*Fauna of British India, Mammalia*, p. 561) remarks : " The wild pigs of Baluchistan and Afghanistan may be *Sus scrofa*, as are, I think, those of Persia and Mesopotamia." The main difference between these two species, the Indian and European ones, lies in the structure of the last molar tooth in each jaw. I have compared the last molar teeth in this series with the corresponding teeth in the jaws of several wild pigs in the collection of the Zoological Survey of India, and I am unable to detect any difference that would justify one in regarding the specimens excavated as being other than *Sus cristatus*.

AVES

? Gallus, sp.

HR 4097 (*b*), depth 3 ft. Upper end of humerus.
Left femur.
Posterior part of skull.
Upper end of tarso-metatarsus of left side.

The few fragments obtained agree closely in their general structure with the corresponding parts of the skeleton of the domestic fowl. They are, however, considerably larger, the length of a complete femur from Mohenjo-daro being 103 mm., whereas in the domestic fowl of Bengal it measures only 69 mm. This difference is, however, probably due to the deterioration of the present race of fowls in this part of India.

REPTILIA

Family CROCODILIDÆ

Gavialis gangeticus, The Gharial

HR 791, depth 10 ft. Part of a vertebra.
Part of a skull.
HR 1142, depth 6 ft. A body dorsal scute.
HR 3721, depth 3 ft. A tooth.

In a region as near to the River Indus as is Mohenjo-daro, it is not surprising that one should come across the remains of one of these river-haunting crocodiles.

CHELONIA

Family TRIONYCHIDÆ

Trionyx gangeticus ?

DK 2399, depth 9 ft. A left femur; the bone had been burnt.
DK 4904 (*a*), depth 11·35 ft. B.D. The Hyo-, Hypo-, and Xiphi-plastron of each side.

Boulenger,[1] regarding the known distribution of this species, remarks: "Gangetic river-system; Indus ?" Prashad[2] has definitely shown that this species is known from the Indus and the finding of portions of the skeleton at Mohenjo-daro makes its occurrence there at this early date more than probable.

In Pl. CLXI, Figs. 4 and 5, I have given photographs of the plastron excavated at Mohenjo-daro [DK 4904 (*a*)] and that of a recent specimen in the collection of the Indian Museum. It will be seen that there are certain differences between the two, especially as regards the combined hyo- and hypo-plastra, which in the Mohenjo-daro specimen is somewhat squarely truncated on its median border, instead of being rounded as in the recent example. There is also a prominent median projection on the hypo-plastron of the Mohenjo-daro specimen, which appears to be only slightly represented in the recent form. In these respects, however, the specimen agrees well with other examples of *Trionyx gangeticus* in the Indian Museum collection. The xiphiplastron is narrower and more elongate than in the recent form. In this respect this specimen agrees closely with the figure of a plastron of *T. cartilagineus*, Bodd, given by Siebenrock[3] (Fig. 7, p. 826). *T. cartilagineus* is, however, an eastern form and at the present time is known only from Burma, Malay, Siam, Cambodia,

[1] G. A. Boulenger, *Fauna of British India: Reptilia*, p. 12.

[2] B. Prashad in *Rec. Ind. Mus.*, vol. x, p. 267.

[3] F. Siebenrock, "Zur Systematik der Schildkrötenfamilie Trionychidæ Bell, nebst der Beschreibung einer neuen Cyclanorbis-Art.": *Sitzungsb. der Math.-Naturwiss. Classe der Kais. Akad. der Wiss.*, Wien, vol. cxi, p. 826, 1902.

and the islands of Sumatra, Java, and Borneo. In spite of these differences from the present-day examples of *T. gangeticus*, I consider it inadvisable to suggest that these remains belong to a different, or to a possibly unknown, form, till more is known regarding the degree of variation that may occur within the limits of any one species.

Chitra indica

DM 18, depth 4–5 ft. Portions of ribs and part of hypoplastron.

This species is stated by Boulenger[1] to occur in "The Ganges and Irrawaddy; Indus ?" It has, however, been taken by Dr. Prashad[2] in the Indus River-system.

Emyda granosa

Trial trench, depth 6 ft.	A complete epiplastron.
" "	A xiphiplastron.
VS 1074, depth 2 ft. 6 in.	A complete epiplastron.
C 1632, depth 1 ft.	A complete hyoplastron.
DK 4904 (*a*), depth 11·35 ft. B.D.	Portion of carapace.

The present-day distribution of this species is given by Boulenger (*Fauna of British India, Reptilia*, p. 17) as "Indus and Ganges plains, in rivers, canals, etc."

The occurrence of these aquatic reptiles is only to be expected in a region such as Mohenjo-daro, in which the close proximity of the Indus river must have rendered the inhabitants perfectly well acquainted with those animals that inhabit it. In most of the fragments that have been preserved there is evidence of charring, and it seems probable that these aquatic reptiles were a source of food at one time or another in the history of the city.

Family TESTUDINIDÆ

Testudo elegans, The common Land-Tortoise

VS 128, depth 1 ft. 2 in. Plastron and part of carapace.

The known range of this species is given by Boulenger (*Fauna of British India, Reptilia*, p. 22) as "India (except Lower Bengal), extending west to Sind and Ceylon".

Damonia hamiltoni

SD 1473, depth 3 ft.

Fragments of both carapace and plastron were present in sufficient numbers to enable the greater portion of the anterior half of the carapace and nearly the whole plastron to be reconstructed; there can thus be no doubt of the specific diagnosis. Boulenger (*Fauna of British India, Reptilia*, p. 34) reports that this species is known to occur in "Bengal, Panjab, and Upper Sind".

Batagur baska ?

SD 188, depth 4 ft. 2 in. Part of a plastron that has been sawn square.
VS 720, depth 9–13 ft. Part of a plastron.

It is with some hesitation that I record this species. The plastron (SD 188) has clearly been sawn, so that the remaining plate is square. I have compared this plate with the corresponding part of the skeleton of a specimen in the collection of the Zoological Survey of

[1] G. A. Boulenger, *Fauna of British India, Reptilia*, p. 16.
[2] B. Prashad in *Rec. Ind. Mus.*, vol. x, p. 267.

India, and the similarity is so close that I believe them to belong to the same species. On the other hand, however, the distribution of *Batagur baska*, as given by Boulenger (*Fauna of British India, Reptilia*, p. 38) is " Bengal, Burma, Malay Peninsula ". It is possible, therefore, that the specimen may belong to some other species ; but equally it is possible that at the time when Mohenjo-daro was an inhabited city this river turtle was living in the Indus. That the remains were contemporaneous with the Mohenjo-daro civilization is clear from the fact that the bone has been sawn into a square to serve some definite purpose.

PISCES

Family SILURIDÆ

Rita rita ?

VS 2571, depth 5 ft.	Cubito-humeral process of the pectoral arch.
" "	Portion of lower jaw.
HR 3948, depth 13 ft.	Pectoral spine.
" depth 15 ft.	A pectoral spine.
VS 125, depth 4 ft. 3 in.	Portion of a pectoral spine.
VS 504, depth 2 ft.	Spine of *Rita ?*

Wallago sp.

VS 504, depth 2 ft.	A portion of the supra clavicle.
VS 2786, depth 5 ft. 6 in.	A portion of the supra clavicle.

Arius sp.

Trial trench, depth 6 ft.	Basal portion of the pectoral spine.
" "	Median portion of a spine (pectoral).

In addition to the above, there were present among the preserved fragments the remains of a typical carp fish.

HR 4623, depth 2 ft.	The basi-occipital bone.
SD 368, depth 6 ft.	The basi-occipital bone.

MOLLUSCA

PELECYPODA

Lamellidens marginalis (Lamarck)

DK 230, depth 1 ft. 6 in. Several shells, including a pair.

This species is widely distributed in fresh water throughout India, Burma, and Ceylon. Dr. Prashad, who has kindly examined these shells, informs me that they " are all half-grown specimens of the typical form of *Lamellidens marginalis* (Lam.), and are similar to those found in the upper reaches of the Panjab river ".

Parreysia favidens (Benson)

SD 1473, depth 3 ft.	Three valves.
VS 496, depth 2 ft. 6 in.	A single valve.
DM 63, depth 4 ft. 6 in.	A single valve.
C 517, depth 7 ft.	Five valves.

This species is widely distributed throughout Northern India, and according to Preston (*Fauna of British India, Mollusca, Gastropoda, and Pelecypoda* (Fresh water), 1915) has been taken in the Indus River and throughout the Gangetic system, as well as in E. Cachar, Sylhet, and the Madras Presidency.

Arca granosa Linn.

HR 2033, depth 8 ft. A single shell.

This is a common species, and is known to occur throughout the coastal waters of Arabia, India, Malay Archipelago, Japan, China, and Australia. It is probable, therefore, that it was imported from the coast in the neighbourhood of Karāchi.

GASTROPODA

Cypræa arabica Linn.

VS 371, depth 5 ft. 6 in. A single specimen in a good state of preservation; the shell had been bored through, presumably for use as an ornament.

This species is common, and is widely distributed throughout tropical seas; Persian Gulf, coasts of India, Ceylon, Burma, New Caledonia, and Australia. It was probably imported from the neighbouring seacoast.

Cypræa ocellata Linn.

C 517, depth 7 ft. A single specimen.

This also is a marine species and must, therefore, have been imported into Mohenjo-daro.

Eburna spirata Lamarck

HR 129, surface. A single specimen.

This species possesses a wide distribution throughout the coasts of India and Ceylon and as far east as the Philippine Islands; probably it was imported to Mohenjo-daro from the neighbouring coast.

Fasciolaria trapezium Linn.

L 751, depth 1 ft.
LS 765, "below first pavement." } These two specimens were taken at random as samples from a large number of examples of this species that had been excavated.

This species is widely distributed throughout Indian Seas, its known range of distribution extending from the Red Sea on the west to the Philippines, Java, China, and Auckland Islands on the east. These shells had clearly been imported for the purpose of making ornaments, such as bangles, and other objects, as spoons, etc. The shells had not been subjected to any cleaning process, as is clearly shown by the occurrence on one of them of the remains of a colony of Polyzoa, belonging to the genus *Membranipora*; the actual species appears to have been *M. hippopus* Levinsen, which is known to occur throughout the coasts of America, Great Britain, the Mediterranean Sea, and India. The same specimen, L. 765, was also bored by a sponge, probably a species of *Cliona*.

Turbinella pyrum, The Sank Shell

Var. *acuta* Hornell

HR 61, surface. A single specimen.

This variety of the sank shell has been recorded from the coasts of Ceylon, South India, and from Kāthiāwār.

Var. *fusus* Sowerby

VS 1179, depth 4 ft. 6 in. A single specimen.

This variety of the śank has, hitherto, been recorded from the Andaman Islands ; but its occurrence along with the other variety makes it probable that it occurred in the same locality and that both specimens had been imported to Mohenjo-daro from the neighbouring coast. Hornell [1] records that var. *fusus* may occur, though rarely, on Indian coasts.

GENUS *INDOPLANORBIS* Annandale and Prashad

Indoplanorbis exustus (Deshayes)

DK (S) 4985, depth 14·15 ft. B.D. A single specimen.

This species is widely distributed throughout India, and its occurrence at Mohenjo-daro is in no way remarkable.

GENUS *VIVIPARUS*

Viviparus bengalensis (Lamarck)

C 517, depth 7 ft. 5 examples.

This species is also of widespread occurrence throughout India, not only in rivers and streams but also in artificial ponds and tanks, where it is of common occurrence in association with *Indoplanorbis exustus* (Deshayes).

MADREPORARIA

Favia speciosa

HR 607, depth 4 ft. A single rounded colony.

This species of coral is at the present day widely distributed throughout the seas of India and the Far East. It has been recorded from the Red Sea, the Seychelles, Chagos Archipelago, the Maldives, Ceylon, the Aracan Coast of Burma, Mergui Archipelago, Cocos-Keeling Islands, the Philippine Islands, Fiji, and the Great Barrier Reef of Australia. It has obviously been imported to Mohenjo-daro, and is probably from the Karāchi or Kāthiāwār Coast. I have to thank Professor G. Matthai, of the Government College, Lahore, for identifying the specimen for me. The specimen was perforated on its upper surface by several holes that lead down into smooth-walled chambers in the coral mass. Each chamber was occupied by the remains of a Lamellibranch mollusc, belonging apparently to a species of Anatinid ; but the fragile shells were too broken to admit of their specific identification.

In all, I have been able to determine the presence of remains of thirty-seven different species of animals. In the following table I have given a list of these animals, and the levels at which they occur.

I Less than 2 feet.	II Between 2 and 7 feet.	III Between 7 and 12 feet.	IV Below 12 feet.
—	*Herpestes auropunctatus*	—	—
Canis familiaris	*Canis familiaris*	—	—
Crocidura bidiana	—	—	—
—	*Mus rattus*	—	—
—	*Elephas maximus*	—	—
Equus caballus	—	—	—
—	*Bos indicus*	*Bos indicus*	*Bos indicus*

[1] J. Hornell, *Marine Zoology of Okhamandal*, pt. ii, p. 3 et seq., 1916.

I Less than 2 feet.	II Between 2 and 7 feet.	III Between 7 and 12 feet.	IV Below 12 feet.
—	*Bos bubalus*	—	—
Ovis sp.	*Ovis* sp.	—	—
—	—	*Cervus cashmerianus*	—
Cervus unicolor	*Cervus unicolor*	*Cervus unicolor*	*Cervus unicolor*
—	*Cervus axis*	—	—
—	*Cervus porcinus*	*Cervus porcinus*	—
—	—	—	*Camelus dromedarius*
Sus cristatus	*Sus cristatus*	*Sus cristatus*	*Sus cristatus*
—	*Gallus* sp.	—	—
—	*Gavialis gangeticus*	*Gavialis gangeticus*	—
—	—	*Trionyx gangeticus*	—
—	*Chitra indica*	—	—
—	*Damonia hamiltoni*	—	—
—	*Emyda granosa*	—	—
Testudo elegans	—	—	—
—	*Batagur baska*	—	—
—	*Rita rita*	—	*Rita rita*
—	*Wallago* sp.	—	—
—	*Arius* sp.	—	—
—	A carp	—	—
Lamellidens marginalis	—	—	—
—	*Parreysia favidens*	—	—
—	—	*Arca granosa*	—
—	*Cypræa arabica*	—	—
—	*Cypræa ocellata*	—	—
Eburna spirata	—	—	—
Fasciolaria trapezium	—	—	—
Turbinella pyrum var. *acuta*	*Turbinella pyrum* var. *fusus*	—	—
—	—	—	*Indoplanorbis exustus*
—	*Viviparus bengalensis*	—	—
—	*Favia speciosa*	—	—

I have made no attempt to correlate the various finds with the different periods of Mohenjo-daro civilization; but have, in a purely arbitrary manner, divided the finds into four groups according to the depth at which they occurred. These depths range from the surface to 17 feet below, and I have taken the first group to include all the remains found in the upper 2 feet, and the remaining three groups are from successive strata, each of 5 feet depth. With regard to the surface stratum, it is impossible to decide to what extent deposition or denudation is occurring, but the presence of a portion of an antler of *Cervus unicolor* (adult), as well as of the shells of two species of marine molluscs, namely *Eburna spirata* and *Turbinella pyrum* var. *acuta*, on the surface, seems to me to indicate that at the present time denudation is progressing, since marine shells cannot have been deposited here nor can this stag have been living recently in this region, and the general character of the horn in no way differs from the fragments found at greater depths.

From the above table it is clear that the number of animal remains steadily increases as we get nearer the surface till we reach the top 2 feet, when it not only drops very considerably but we now get the remains of certain wild or semi-wild animals, such as *Canis*

familiaris, *Crocidura bidiana*, and *Testudo elegans*, as well as the remains of the horse, which appears to be absent from the lower levels. The gradual decrease in the number of animals represented in the collection as we reach the lower strata may be due, at any rate in part, to the nature of the soil, but still more to the fact that only a comparatively small area of the lower strata has been excavated. At Mohenjo-daro and throughout the country round the soil is impregnated with saltpetre that rapidly causes the deterioration and final decay of bony objects, and it is possible that the paucity of animal remains from the deeper levels is due to this ; on the other hand, it may be that, with an increase or at least a modification of the state of civilization, more animals were introduced as domesticated herds; this would account for the later presence of *Bos bubalus*, *Ovis* sp., and *Elephas maximus* in the 2–7 ft. level, and their apparent absence from the earlier strata, while similarly the utilization of further natural food-supplies would account for the presence in this level of the remains of *Batagur baska* and *Emyda granosa*, and a larger number of fish.[1] The remains can be classified as follows :—

(*a*) Animals probably maintained in a state of domestication :—

Bos indicus
Bos bubalus
Ovis sp.
Elephas maximus
Camelus dromedarius ?
Sus cristatus
Gallus sp.
and at a late date
Equus caballus.

(*b*) Animals that may be termed semi-domesticated, in that they frequent the vicinity of human habitations :—

Canis familiaris
Herpestes auropunctatus
Crocidura bidiana
Mus rattus.

(*c*) Animals caught and probably utilized as food :—

? *Sus cristatus*
? *Gavialis gangeticus*
Trionyx gangeticus
? *Chitra indica*
? *Emyda granosa*
Damonia hamiltoni
? *Batagur baska*
Rita rita
Wallago sp.
Arius sp.
A carp.

[1] As our excavations have rarely penetrated below the upper strata, it seems to me too soon to draw conclusions on these subjects.—[Ed.]

(*d*) Animal remains, such as shells, imported for ornament or use :—

Batagur baska
Lamellidens marginalis
Arca granosa
Cypræa arabica
Cypræa ocellata
Eburna spirata
Fasciolaria trapezium
Turbinella pyrum var. *acuta*
" " var. *fusus*
Favia speciosa.

(*e*) Animal remains imported possibly for medicinal purposes :—

Cervus cashmerianus
Cervus unicolor
Cervus axis
Cervus porcinus
} horns only.

(*f*) Animal remains occurring fortuitously :—

Indoplanorbis exustus
Viviparus bengalensis.

Animals maintained in a state of domestication

The very considerable frequency with which the remains of *Bos indicus* have been met with during the excavations indicates that the inhabitants of Mohenjo-daro at one stage or other of their history maintained large herds of this animal. In quite a large number of cases the teeth indicate that the animal from which they were derived was young ; for instance, in the case of the third molars there has, in many cases, been but little wearing down of the tooth surface, while in a few instances this tooth has only just been erupted. This would appear to indicate that the inhabitants slaughtered these animals for food, and it is possible that this may also provide the explanation of the total absence in the collection of any complete long bone belonging to this species ; probably such bones were split in order to obtain the marrow.

It seems clear that the pig was present in large numbers in this area from the very earliest time when Mohenjo-daro was a flourishing city ; but it is impossible to determine whether or not this animal was actually domesticated or even whether it was used as a source of food by the inhabitants in those far-off times. At the present time pigs are of common occurrence throughout these parts, and it is possible that in the old days they existed in large herds that roamed the countryside searching for food. At the present day in and around the city of Bīkaner in the Rājputāna desert the wild pig thrives, and each night large numbers of them wander into the city to feed on the refuse and other matter that has been thrown out by the inhabitants ; indeed, in Bīkaner the pig performs the function of a drainage system for the removal of sewage, and it is possible that in Mohenjo-daro in the old days they served the same purpose. If so, it is not surprising that their remains are to be found in large numbers.

That the inhabitants of Mohenjo-daro also kept poultry is highly probable, for unmistakable clay figures of these birds, among others, have been excavated, but although a number of avian bones have been excavated, I am at present unable to say with certainty whether any or all of these belong to domestic poultry or to wild birds. As regards their size, they are for the most part considerably larger than the present-day race of fowls.

Animals caught for food

With the exception of the carp, all the remains of fish are from examples of the family *Siluridæ* ; of the three genera represented, two, viz. *Rita* and *Wallago*, are common inhabitants of the large rivers of India. As regards *Rita*, Day (*Fauna of British India*, *Fish*, p. 165) remarks that their distribution is " Large rivers of Sind, India (except its southern portions), and Burma far above Mandalay " ; and *Wallago* (loc. cit., p. 126) is said to occur in the " Fresh Waters of India, Ceylon, Burma, and Cochin China ". In the case of *Arius*, the distribution is given by the same authority (loc. cit., p. 170) as the " Seas and estuaries of tropical regions, ascending to within tidal influence or even entering fresh waters ". All the three species are well known to be excellent food-fish, and it is probable that they were used for food in the past at Mohenjo-daro ; examples of the first two genera, *Rita* and *Wallago*, were probably caught locally, but it is not likely that a fish such as *Arius*, which is normally confined to estuarine or tidal regions, would penetrate so far up stream as this, and it seems more likely that these fish were caught further down the river in the neighbourhood of Karāchi and were dried and brought up to Mohenjo-daro. At the present day large quantities of this species are caught, dried, and salted on the west coast of India and are exported up country, and possibly a similar trade was in existence in past days also.

The presence of the remains of a number of other aquatic animals, such as the Gharial and turtles, remains of which in many cases have been burnt, indicate that such animals were even in these early times an ingredient of the food of the inhabitants. Annandale[1] remarks : " In the Gangetic delta, and I believe in the other parts of India, *Trionyx* is regarded as an important article of diet," and Prashad[2] states that " in the Panjab tortoises are not much esteemed as an article of food except by the nomad tribes. The *Sahnsies* consume them in quite large numbers . . . The flesh is eaten, while the fat is stored and used instead of oil or for making embrocations. The *Sickligars* also eat these animals, but in much smaller numbers." This raises the question as to how these animals were obtained. That the fish were deliberately sought for and caught can, I think, safely be assumed, and it is highly probable that the methods employed for catching fish were by means of nets, traps, or hook and line. Where fish are caught by means of nets or traps in such a river as the Indus, it is certain that from time to time such other inhabitants of the river as turtles, *Trionyx gangeticus*, *Chitra indica*, *Batagur baska*, and *Emyda granosa*, will also be caught, and it is not improbable that the Gharial, *Gavialis gangeticus*, was captured in the same manner. It is possible that these turtles or the crocodile were speared, but such fragments of the shell or skeleton as have been preserved do not show any hole or holes, such as would be caused by a spear.

Animal Remains imported for Ornament, etc.

The occurrence of the shells of *Lamellidens marginalis* in the uppermost levels appears to indicate that it was only in the later period that they were imported and used as ornaments by the inhabitants of Mohenjo-daro. As regards the marine molluscs there seems no doubt that a regular trade was carried on between Mohenjo-daro and the seacoast. As Hornell[3] points out, at the present day, apart from the Gulf of Mannār and Palk Bay, the coast of Kāthiāwār is the only considerable source of śank shells ; and in very early times śank cutting centres existed in the Southern Deccan and in Kāthiāwār and Gujarāt. While

[1] N. Annandale, "The Indian Mud Turtles" in *Rec. Ind. Mus.*, vol. vii, Calcutta, 1912.

[2] Baini Prashad, " Notes on Aquatic Chelonia of the Indus System," Miscellanea : *Rec. Ind. Mus.*, vol. x, p. 267, Calcutta, 1914.

[3] *Marine Zoology of Okhamandal*, vol. ii, *The Indian Chank*, p. 71.

the actual cutting of the śank shell must have been done by means of metal saws, the fragments in some of these early sites are associated with flint or stone implements, as in the case of the neolithic flint implements at Batapur and Damnagar, Amreli Prānt, in Kāthiāwār, or with sandstone hammers at Kamrey in Gujarāt; and the same is the case at Mohenjo-daro, where flint implements have also been found. At the present time, as probably in times past also, the actual cutting of the śank bangles is an industry that is peculiarly localized, and not infrequently the site of this industry has no direct connection with the region where the śank shells are fished from the sea. At the present day, the main centre of the bangle-making industry is situated at Dacca in Eastern Bengal, while the śank shell is fished either at the extreme south of India, in Palk Bay and the neighbourhood, or on the west coast of India off Kāthiāwār. In addition to the actual bangles or fragments of bangles that have been excavated, the presence of a number of cores, from which the bangles have been sawn, clearly shows that in times past Mohenjo-daro was also a centre of the bangle-making industry.

Animal Remains imported for Medicine

The presence of the remains of four different species of deer among the various animal remains that have been excavated is of considerable interest both from the cultural and the zoological points of view. If these remains are taken to be evidence that these animals were in past times actually inhabiting this part of the country, then there can be little doubt that there has been a very great change in the character of the terrain during the years that have intervened between the final destruction of Mohenjo-daro and the present time. Of the four species represented in the collection only one, namely *Cervus porcinus*, the Hog-deer, is at the present day an inhabitant of Sind and the area around the site of the excavations. According to Blanford (*Fauna of British India, Mammalia*, p. 550), the Hog-deer at the present day is found " in the Indo-Gangetic plain everywhere from Sind to the Panjab. It is an inhabitant of alluvial plains ". One would, therefore, not be surprised to find the remains of this animal; but as regards the other three, not one of them is now known from anywhere in the neighbourhood. The spotted deer, *C. axis*, is at the present time found, according to Blanford (*Fauna of British India, Mammalia*, p. 548), " nearly throughout India and Ceylon. It occurs at the base of the Himalayas, not, however, ascending the mountains beyond the lower spurs, from the neighbourhood of the Sutlej to Nepal. *It is not found in the Panjab plains, nor in Sind*, and only to the eastward in Rajputana ".[1] The Sambur, *C. unicolor*, though having a wide distribution (*vide* Blanford, *Fauna of British India, Mammalia*, pp. 544–5) " almost throughout the Oriental region wherever there is undulating or hilly country with forest ", is " *of course wanting in the treeless plains of the Panjab, Sind, and Western Rajputana.*"[1] In both these cases the natural habitat is found among the dense vegetation of forests and woods, and it is hardly necessary to point out that such vegetation is at the present time not found anywhere in the vicinity of Mohenjo-daro. The fourth deer that has been identified among the remains, namely the Kashmīr Stag, *C. cashmerianus*, is at the present day found, according to Blanford (*Fauna of British India, Mammalia*, p. 537), in " the Kashmir valley, throughout the pine forests between 9,000 and 12,000 feet in summer, lower in winter. Not found east or north of Kashmir; a few occur in Wardwan, Kishtwar, Badrawar, etc.; none in Ladak. The range westwards is not known ". According to Adams,[2] these stags " roam from forest to forest, preferring grassy glades, alternating with dense forest, where there is a copious supply of water ". It would be a matter of considerable difficulty to find in the whole of India an area of country that is less like the

[1] The italics are mine.—R. B. S. S. [2] Adams in *Proceedings of the Zoological Society*, 1858, p. 529.

natural habitat of these three members of the genus *Cervus* than the desert conditions that at the present day exist throughout the greater part of Sind ; and it is remarkably significant that the only remains of these deer that have up to the present time been excavated are the horns. If the animals had been living in this region during the time when Mohenjo-daro was a flourishing city, it is more than probable that at least some of the teeth and other parts of the body would have been preserved. From the evidence I think it is more probable that the horns were imported from some other region. From olden times down to the present day stag's horn has been used in medicine, and in many of the fragments of antlers that have been excavated it is clear that the antler has been sawn through, the fragment terminating below in a cut surface, while in others the antler had equally clearly been shed in the natural way and had subsequently been collected. Apart from the specimens that I have enumerated above, there are in the collection a number of smaller fragments and isolated tines. I have not given these in the list, since it is not possible to decide with certainty from which species of deer they were originally derived. Among these smaller fragments are several that, in addition to the flat end, have cuts and notches in the side of the horn, where small fragments have been removed. The flat end may have been produced either by sawing when the part was removed from the original antler, or may subsequently have been ground down during the process of making a powder, in which form the horn is utilized as medicine. The presence of these fragments is strongly in favour of the view that stag's horn was in past times at Mohenjo-daro a commercial commodity and was imported for medicinal or other purposes.

In conclusion, I must record my indebtedness to my colleagues of the Zoological Survey of India for the assistance that they have given me in the correct identification of many of these fragmentary remains.

EXPLANATION OF PLATE CLXII

FIG.

1. The skull of *Bos indicus* from the collection of the Zoological Survey of India (from in front).
2. The skull of *Bos indicus* from the collection of the Zoological Survey of India (from the right side).
3. Fragments of skull of *Bos indicus* from Mohenjo-daro.
4. The plastron of *Trionyx gangeticus* from the collection of the Zoological Survey of India.
5. The plastron of *Trionyx gangeticus* from Mohenjo-daro.

EXPLANATION OF PLATE CLXIII

FIG.		
1.	*Crocidura bidiana.*	Skull from the dorsal aspect; × 2. From Mohenjo-daro.
2.	„ „	Skull from the dorsal aspect; × 2. Recent, ex coll. Z.S.I.
3.	„ „	Skull viewed from the side; × 2. From Mohenjo-daro.
4.	„ „	Skull viewed from the side; × 2. Recent, ex coll. Z.S.I.
5.	*Herpestes auropunctatus.*	Skull viewed from the dorsal aspect. From Mohenjo-daro.
6.	„ „	Skull viewed from the dorsal aspect. Recent, ex coll. Z.S.I.
7.	„ „	Skull viewed from the side. From Mohenjo-daro.
8.	„ „	Skull viewed from the side. Recent, ex coll. Z.S.I.
9.	*Equus caballus.*	Lower jaw, right side; × ½.

LIST OF ADDITIONAL SPECIMENS

MAMMALIA

DK 3702	Chamber 189	8·9 ft. below datum	Upper portion of shaft of right humerus with bicipital groove. Portions of a pair of ulnas and part of shaft of a fibula. Almost certainly *human*.

SD 2828	Chamber 41	3·5 ft. above datum	Fragments of bones. One Phalanx. Fragments of horn (? sawn off at butt-end), probably of *Cervus porcinus*, the Hog Deer. Great trochanter of femur of small mammal (? sheep or deer).
DK 3964	Chamber 238	10·0 ft. below datum	Fragments of bone. Undeterminable.
DK 4021	Chamber 2541	30·08 ft. below datum	Portion of shaft of bone, probably Sambar, *Cervus unicolor*.
DK 4051	Chamber 264	10·84 ft. below datum	Fragments of a tooth of *Elephas indicus*.
DK 4319 (*a*)	Chamber 53	6·6 ft. below datum	Fragments of bone, undeterminable.
DK 4385	Chamber 187	13·6 ft. below datum	Part of horn of Sambar, *Cervus unicolor*. Base of horn and brow tine of a large deer probably either Sambar, *Cervus unicolor*, or Bārasingha, *Cervus duvauceli*.
DK 4632	Chamber 203	11·9 ft. below datum	Shaft of bone of a Sambar, *Cervus unicolor*.
		PISCES	
DK 4624	Chamber 305	9·2 ft. below datum	Spine of *Rita rita* (Ham. Buch.). A fresh-water fish.
		MOLLUSCA	
DK 3395	Chamber 56	6·0 ft. below datum	Shell of a śank (*Turbinella pyrum* Linn. var. *acuta* Hornell). Marine.
DK 3484	Chamber 127	3·6 ft. below datum	Shell of *Conus* (*Leptoconus*) *monile* Hwass. A marine species.
DK 3860	Chamber 36	6·25 ft. below datum	Shell of *Zootecus insularis* (Ehrenberg). This species of land snail has a wide distribution throughout India and beyond to Cameran Islands, Red Sea, Cape Verde Islands, and Senegambia, Egypt, Abyssinia, South Arabia, and Balūchistān. The genus occurs chiefly in arid or barren regions.
DK 4488	Chamber 71	4·1 ft. below datum	Shell of *Arca* (*Anadra*) *granosa* Linn. A marine species.
DK 4624	Chamber 305	9·2 ft. below datum	Shell of *Potamides* (*Telescopium*) *telescopium* (Linn.), a brackish-water form.

All the marine forms could be obtained on the Kāthiāwār Coast or in the neighbourhood of Karāchi and the brackish-water forms from the Indus Delta.

CHAPTER XXXII

MINERALS AND METALS

GOLD

NONE of the economically useful minerals is more widely distributed over India than gold, except perhaps iron. The sands of the majority of its rivers have yielded gold, though usually in very small quantities, when washed. Gold-washing has, in fact, been practised in the past in every province of India. The streams of the Dhārwār district of Bombay have, for instance, yielded gold, and traces of old workings are to be seen in the Sāngli State and near Hosūr. In Hyderābād (Deccan) ancient workings have been noticed at Hutti (16° 12′ : 76° 43′), Topuldodi (16° 10′ : 76° 51′), and Wondalli (16° 14′ : 76° 48′). All these areas have since been mined on a large scale. The workings at Hutti contain the deepest ancient shafts known in India, one of them being 620 feet in depth. In Madras, old workings have been found in the following districts : Anantapur (near Rāmgiri, 14° 18′ 30″ : 77° 33′), Coimbatore (Bensibetta, 11° 42′ 30″ : 77° 21′ ; Hadabanatta, 11° 56′ 30″ : 77° 21′ 30″ ; Kavudahalli, 12° 4′ : 77° 30′ ; and near Porsegaundanpālayam, 11° 53′ 30″ : 77° 21′), and Wynaad. The old workings in S.E. Wynaad were made by a mining community known as *karumbars*, and were discovered in 1831. Prospecting on modern lines at Wynaad has not led to any successful development. Eastwick has endeavoured to show that the great sources of gold reported as having been seized by the former invaders of India came from the Wynaad mines ; he, in fact, identifies India as the land of Ophir.[1] In Mysore, old workings are widely distributed, and gold has been found in every district except that of Bangalore. From the Kolār District comes over 90 per cent of India's production. Occurrences in Mysore are too numerous to mention in detail. The value of the annual output of gold in India a few years ago was well over £2,000,000, though it is a little less than this at present.

In Afghānistān, gold occurs 3 miles north of Kandahār. It is obtained in small quantities also from the north side of the Hindu Kush. Other reported sources are the streams draining the Kūh-i-Bāba, streams in Kohistān, and above Laghmān and Kunar.

The following are the known gold localities of Persia, but this country can scarcely be regarded as a rich gold-producer : (1) Dāmaghān south of Asterābād, (2) between Nīshāpūr and Meshed and 2 miles west of Meshed, (3) 4 miles west of Zenjān (N.W. Persia), (4) Tihrān Hills, west of Ispahān, (5) the Elwend hills near Hamadān, (6) near Geligah in Māzandarān, (7) near Shāh Abdul Azīm, S.E. of Teherān—in an old lead mine, (8) N.W. of the ruins of Takht-i-Suleimān, west of Zenjān, and (9) Kūh-i-Tukh Rāja.

[1] *Gentleman's Magazine*, ccxlvi, pp. 96–114.

Western Tibet is thought to be rich in gold; modern supplies are said to be entirely alluvial.

Siberia is rich in gold. Gold is washed in many places in the Kārākoram and in many of the rivers of Central Asia; the metal is obtained from mines in the western and middle Kuen Lūn mountains.

The output of gold from China is not far short of that from India.

In ancient times Arabia was an important gold-supplying land, and is supposed by many to have included the old gold localities of Havila and Ophir.

From the above it will be seen that there are many possible sources for the gold of Mohenjo-daro, but the chances seem more in favour of Southern India. The gold of India is said to have been worked for at least twenty-five centuries.[1] In Mysore (Kolār) the occurrences are rich and noticeable, and although Afghānistān, Western Tibet, and parts of Persia are nearer, Southern India would seem to have been the most accessible.

Silver

In the Bhāgalpur, Mānbhūm, Monghyr, and Singhbhūm districts of Bihār and Orissa, silver has been found associated with lead, but neither metal in considerable quantity. Similar occurrences have been met with in the Rewah State, Central India, and in the Drug, Hoshangābād and Jubbulpore Districts of the Central Provinces. Old argentiferous lead mines occur in the Cuddapah and Karnūl districts of Madras. The Kulu valley of the Panjāb Himālaya is rich in argentiferous galena.

Silver associated with gold is produced in considerable quantity to-day at Kolār in Mysore, and to a much smaller extent at Anantapur in Madras. Excluding Burma and the two last-mentioned localities, India at the present day yields no silver. Professor V. Ball, however, was "inclined to accept literally certain ancient and long-forgotten references to its (India's) having been a silver-producing country" (*Journ. Soc. of Arts*, 28th April, 1882, p. 582).

An ancient lead-mine, the lead from which yields a small quantity of silver, exists at Fārinjal (35° 0' : 68° 44') in the Ghorband valley of Afghānistān. Silver may also have been derived from the many other lead localities of Southern Afghānistān (see "Lead"). In the same country well-known silver mines existed near the head of the Panjshīr valley in the Hindu Kush; silver deposits were also formerly worked near Herāt.

Persia is said to be very rich in silver-bearing lead-ore; otherwise, its supplies appear to be limited. In S.E. Persia, silver is known to occur in the Kuh-i-Nugre ("silver mountain"), between Fasā and Zahidān, near Herāt, in the Sahend hills near Tabrīz, and at Guleki not far from Asterābād.

The rich lead and silver deposits of Northern Burma had been exploited by the Chinese for many centuries back, and are now yielding something like 5 million ounces of silver a year.

The silver mines of Gumush Khaneh in Armenia were exceptionally rich and well known in olden times. Small quantities of silver are known to occur in the old land of Midian (now the Hedjāz), and there is an old silver and copper mine at Shaman on the left bank of the Wadi-el-Yrdh in the interior of Arabia.

If the ancients knew how to separate silver from gold, it is possible Mohenjo-daro supplies may have come with the gold from Southern India. The art of separating silver from lead has been known for many generations, so that the Faranjal mine of Afghānistān, the Gumush Khaneh mines of Armenia, and the many lead mines of Persia, and even the lead mines of North Burma, might be looked upon as possible sources.

[1] J. M. Maclaren, *Gold*, pp. 238–40.

Copper

The best known deposits of copper in India proper are those of Singhbhūm in Bihār and Orissa. Remains of old excavations and mounds of copper slag from a worked-out ore have been noted in Indore. Old copper workings are frequent in Madras—Coimbatore, Guntūr, and more especially Nellore; the last mentioned District seems to have been of some importance. Many places in the Panjāb and Rājputāna yield copper, the most important being Khetri (28° 0′ : 75° 51′) and Singhāna (28° 6′ : 75° 54′), both in Jaipur. Large heaps of copper slag have been noted at Rohira (24° 37′ : 73° 1′ 30″) in Sirohi State. Copper has been obtained by native methods in many places in Sikkim and Kumaon. An old copper mine is known in Kashmīr (Harpat Nāg). At Robāt (29° 32′ : 63° 35′) in Balūchistān, large heaps of copper slag witness to ancient smelting operations.

In Afghānistān ancient copper workings have been found near the Safed-Kūh between Kābul and Kurram. Rich veins of copper-ore are also said to exist in the Shāh Maqsūd (31° 53′ : 65° 20′), and to have been worked by Nādir Shāh and the Sirdars of Kandahār.[1] Rich ores are reported to occur at Nesh, 60 miles north of Kandahār. Other localities are Tezin, east of Kābul, Mūsāī in the Shādkāni Pass, and the Silwātū Pass; some of these places have been worked.

Copper-ore is abundant in Persia. One of the richest localities is the Kārādāgh hills north of Tabrīz. Other well-known mines are those around Kirmān. Polak says of Persia: "Eine Kupfermine hat fast jeder District."[2]

The most important copper mine in Armenia is that of Kadabek. Copper is known to occur in many places in the Caucasus. Eusebius-Hieronymus speaks of the copper mines of Southern Syria; the Shaman mine has already been mentioned (see "Silver").

Considerable quantities of copper are described as coming from the Zangskar valley of Tibet.

China is a small producer of copper, but there is a rich mine in Yunnan, and copper accompanies the lead and silver ores of North Burma. The copper districts of Russia are all in the Urals, Caucasus, or Siberia.

Old and rich copper mines exist at Tokat in Asia Minor.

The nearest copper localities to Mohenjo-daro are: the Jaipur State of Rājputāna, the Shāh Maqsūd and other areas in Southern Afghānistān, and Robāt in the extreme west of Balūchistān. To these we may perhaps add the Nellore district of Madras as a possible source for the ancient city's supplies.

Lead

Considerable quantities of lead-ore were formerly extracted from mines near Ajmer in Rājputāna. Lead is known to occur at several places in Bihār and Orissa, the Central Provinces and the Cuddapah and Kurnool districts of Madras. The most important deposits of the present Indian Empire are those of Northern Burma; these mines are amongst the largest in the world. There are several other unimportant occurrences of lead in other parts of India. With the exception of iron, there is perhaps no metal whose ores appear to have been worked to so large an extent in India as have those of lead. The ancient workers devoted their attention to the extraction of silver rather than of lead; in North Burma, for instance, most of the lead was dumped as waste by the old Chinese workers.

[1] *Cal. Journ. Nat. Hist.*, vi, p. 597.

[2] *Persien*, Theil 2, p. 174, Leipzig, 1865.

An ancient lead mine with very extensive workings has already been referred to (under "Silver") as occurring at Fāranjal (35° 0′ : 68° 44′) in the Ghorband valley of Afghānistān. Lead-ores are common in many localities in Southern Afghānistān, and are said to occur in quantities in the Hazāra Jāt.

Persia is particularly rich in lead, and the mine near Ganjabād appears to have been worked from time immemorial. The richest mines occur around Ispahān, Kirmān, Teherān, and in the Elburz mountains.

Tunis is also a rich lead-bearing country, producing to-day over 5,000 tons a year. The lead of Laurium in Greece was worked on a large scale in ancient times. The only deposit worked in Egypt at the present time is that of Gebel Rosas, which was known to the ancients.

Asiatic Turkey and China both produce lead in some quantity to-day, and the metal is known to occur in remunerative amounts in parts of Siberia.

The Mohenjo-daro lead may well have come from Ajmer. The old mines in this District were of great extent, and in 1830 had the appearance of having been worked for centuries. The metal may otherwise have come from the Fāranjal mine in Afghānistān, or other mines in the south of that country, or from Persia.

Lapis-lazuli

Extraordinary little is known regarding the precise locality in which lapis-lazuli is mined. The name is derived from the Persian word *lajward*, meaning "blue colour", through the Greek λαζούριον, so that a Persian-speaking country is rather indicated as that in which the rock—for it is a rock rather than a simple mineral—was first discovered and used. It is recorded from the neighbouring countries of Tartary, Tibet, and China, but the best known and most important locality is the valley of the Kōkchā south of Firgāmu in Badakshān, the most northerly province of Afghānistān. Another locality is the western end of Lake Baikal in Siberia. It has been reported to have been found near Ajmer, in India, but the report has never been confirmed.

The lapis-lazuli reported to occur in China, Persia, Tibet, and Bokhāra is probably imported material from Badakshān; as is also that sold in India, Afghānistān, and Balūchistān. The material used by the ancient Egyptians for making scarabs is thought to have been obtained from Persia, but may well have come through that country from Badakshān. The same may be said regarding the small amount of lapis-lazuli used in Assyria, Babylonia, and elsewhere in ancient times.[1] Some of the stone referred to by the ancients as sapphire was, from its description, more probably lapis-lazuli.

It seems most probable that the lapis-lazuli of Mohenjo-daro came from the Badakshān Province of Afghānistān.

Turquoise

Turquoise derives its name from the country of Turkey, but although the European supplies were obtained from this country, there is reason to believe that they originated from Persia and merely passed through Turkey. Turquoise takes on a greenish tinge on exposure to sunlight, and for this reason most ancient ornaments of this mineral are definitely greenish in tint.

The finest turquoise is found in Persia, where the mines are known to have been worked for at least eight centuries. The principal locality is near Nīshāpur in the Khorāsān Province;

[1] M. Bauer and L. J. Spencer, *Precious Stones*, p. 442.

other localities are near Kirmān and Kārik, and near Māshīz. Recently the mineral has been found in the neighbourhood of Yezd and in Seistān. Turquoise is also said to occur in Turkestān. Turquoise mines have been stated to exist beyond the Persian frontier between Herāt and Western Turkestān (Khojent and the Kārātyube mountains).

Arabia proper also probably contains turquoise; at least three mines are said to be situated in the "Midianite country".

The report that turquoise occurs in the Ajmer hills of Rājputāna is in all probability incorrect. The stone used for ornaments for the hill women of India and for the mosaic work of Kashmīr probably comes from Khorāsān.

It seems most probable that the ultimate source of the Mohenjo-daro turquoise was the Persian province of Khorāsān.

Amazon Stone

Formerly Amazon Stone or Amazonite, a green variety of microcline felspar, was obtained exclusively from the vicinity of Miyask, a town in the Ilmen mountains, which are a southern continuation of the Urals. Microcline is common in India, but the precious variety has so far been recorded only from Dodabetta in the Nīlgiri Hills, and possibly from the Padar District of Kashmīr. The Mohenjo-daro material may well have come from either of these localities.

Crystal

Rock crystal is a very common form of semi-precious silica or quartz, and is fairly widespread in its occurrence. For this reason it would be difficult to decide whence the Mohenjo-daro material emanated. The lapidaries of Cambay obtain their supplies from Tankāra (22° 40′ : 70° 48′ 30″) in the Kāthiāwār peninsula. Large prisms were formerly obtained in the bed of the Godāvarī near Rājahmahendri, and in the stream-beds of Tanjore, both in Madras. Delhi was formerly another source. Interesting little bi-pyramidal crystals have for a long time been obtained from the red marls of Māri in the Miānwāli district of the Panjāb; they are known as "Māri diamonds".

Rock crystal has been worked at many localities in India, and wonderful ornaments carved out of this stone were found in the old palace of Delhi.

The Alps and India are supposed to have furnished the ancients with their supplies of rock crystal, and it is not unlikely that the Mohenjo-daro inhabitants obtained theirs either from Māri, from the Kāthiāwār peninsula, or from Vellum in the Tanjore District of Madras.

Steatite

Steatite or soapstone is a massive form of talc, a mineral which is said to have derived its name from the Arabic *talq*. The Egyptians used it usually coated with blue glaze, and it was not unknown to the Assyrians and the Chinese. Its most conspicuous properties are resistance to heat and great softness, the latter character permitting it to be very easily carved.

The mineral is widely distributed among the crystalline rocks of India. Some 1,000 tons are produced annually. The localities are too numerous to be all mentioned, but the nearest of any importance to Sind are: (1) Rājputāna (Dogetha, 27° 7′ 30″ : 76° 20′; Gisgarh, 26° 53′ : 76° 42′; and Morra, 26° 48′ 30″ : 76° 52′ 30″); (2) Mysore (several districts); (3) Madras (several districts, especially Salem, Bellary, and Karnūl); (4) Jubbulpore District of the Central Provinces; (5) Bihār and Orissa (several districts, especially Singhbhūm, Mayūrbhanj, Mānbhūm, and Cuttack).

The present-day production comes mostly from Jubbulpore and Salem.

Just below the second bridge above Gōgāmand in Afghānistān, traversing a dark serpentine, is a thin vein of steatite ; it is too thin to be of economic value to-day, but the stone is of excellent quality.

The most likely source of the Mohenjo-daro material would seem to be Rājputāna.

Alabaster

True alabaster is a hydrated sulphate of lime, but the name was applied in ancient times generally to the carbonate. True alabaster is sufficiently soft to take a scratch from the finger-nail, and does not effervesce with hydrochloric acid ; by these simple tests it can be distinguished from the carbonate. Oriental alabaster, the carbonate of lime, was used in Ancient Egypt for canopic jars and other objects. The derivation of the name is doubtful, but may have its origin in the *alabastra*—ointment vases or perfume bottles—which were formerly made out of this stone. It is found as travertine deposited from calcareous springs or as a stalagmite on the floor and walls of limestone caverns. The mineral was extensively worked near Suef and Assiut in Egypt, and many ancient quarries have been found in the hills above the Tel-el-Amarna plain. A very beautiful arragonite travertine occurs in considerable quantity 1½ miles west of Tōpchī on the road to Bāmiān in Afghānistān; a similar rock is found in the hills behind Jabal-us-Sirāj, but in very small quantity.

Hydrous sulphate of lime is a form of gypsum, and is the material to which the term "alabaster" is applied to-day ; this mineral, however, was undoubtedly used by the ancients, for instance, by the Assyrians ; in the ancient city of Calah (Nimrud) blocks of carved and inscribed gypsum can still be seen.

In Europe the alabaster of Tuscany is the best known.

Gypsum is abundant in Persia, Mesopotamia, and over a large part of India. Alabaster is merely a refined and semi-transparent form of gypsum ; how much, if any, of the Persian or Mesopotamian material is sufficiently fine-grained or delicately shaded to warrant the term "alabaster" is not known. A beautifully marbled or mottled alabaster is described as coming from near the village of Ahar, north of Teherān, on the north side of the Kūh-i-Shamīrān.

Gypsum occurs largely in all the younger Tertiary deposits of Afghānistān. The bed at Dasht-i-safed in Kāmard is of the semi-translucent variety known as alabaster, and would make a very handsome ornamental stone ; it is nearly 20 feet thick, and very large quantities are available.

Gypsum is plentiful in the neighbourhood of Mohenjo-daro itself, and some suitable fine-grained bed was probably available at no great distance from the city. Thick beds of it of sufficient purity are found in the Kīrthar range of Sind, and, according to Dr. Buist,[1] "the art of making 'plaster of Paris' from it was known to the natives."

The gypsum of Kachhī in Balūchistān is said to be well adapted for ornamental purposes ; considerable quantities are also available from the Ghāzībād pass, the Bugti and Marri hills, and from near Khattān and Spintangi.

Cutch contains large quantities of the mineral, and a certain amount is obtainable in Kāthiāwār and Rewā Kāntha. Thick beds of it occur in the Sherāni Hills. Gypsum in enormous quantities, including massive beds of considerable purity and variety of colour, extend along the base of the Salt Range in the Panjāb ; a compact variety found near Sardi (32° 41′ : 72° 47′) has been quarried and turned to form plates and other utensils. The gypsum of Rājputāna is mostly impure.

Any of these local sources may have supplied Mohenjo-daro with true alabaster.

[1] *Trans. Bomb. Geol. Soc.* (1852), x, p. 229.

Hæmatite

Crystalline hæmatite has been, and is still, used for ornamental purposes. Suitable material is, for instance, obtainable in Spain. The kind of hæmatite used for ornamental purposes is the extremely hard, fine-grained compact material or large crystals. Reports do not always describe the precise nature of the ore, and it is therefore difficult to guess how much, if any, of a deposit is suitable for ornamental purposes. Enormous quantities of hæmatite occur in Bihār and Orissa and its Federated States, and much of this is hard fine-grained compact ore with a good metallic lustre. Iron-ore deposits have a habit of concealing themselves, and the Bihār and Orissa deposits have only recently been discovered; specimens, however, may well have been picked up in the stream-beds by the ancients and used for ornamental purposes. Large quantities of hæmatite occur also in the Central Provinces. Most of the Madras and Mysore iron-ore is the magnetic variety, but hæmatite is also known; the manufacture of "Wootz steel" in the Trichinopoly District is an ancient one. Hæmatite occurs in Rājputāna and the Panjāb in no very large quantities, and is found in many parts of Persia. The largest occurrence in Persia is just east of Yezd. The iron mines of Lebanon were known to Solomon and included hæmatite. In Southern Arabia the old town of Usal provided the Israelites with iron. The material used by the lapidaries of Oberstein is said to come from India.

The occurrence of hæmatite in the islands of the Persian Gulf and on the opposite coast of Persia is perhaps worth special mention in view of the fact that the mineral is unusually conspicuous and must have attracted attention in very early times. The principal hæmatite-containing island is Hormuz, but the mineral is also found in Qishm, Bū Mūsa, Lārak, Sīrri, Dalmeh, probably Henjām, and several others, as well as on the Persian coast in the neighbourhood of Khamīr. It seems more than likely that the Assyrian and Babylonian supplies came from these, and this coast, and the Mohenjo-daro supplies may well have done the same.

Amethyst

The term "Oriental Amethyst" is sometimes applied to violet-coloured corundum. True amethyst or violet-coloured quartz is found in a very pure state in the gem-gravels of Ceylon. The amethyst localities in the Urals, where the stone is accompanied by beryl and topaz, are extremely important, especially around Ekaterinburg. Amethyst is not a rare mineral, but is casual in its occurrence; in olden times it was obtained from Arabia Petræa.

The mineral has been found in the Santāl Parganas of Bihār and Orissa, and occurs sometimes in the geodes of the Deccan Trap; the latter rock in Jubbulpore has yielded small amethysts in this way. The occurrence of amethystine quartz in the vicinity of Hyderābād (Deccan) has been noted. Amethyst is found at several localities in the Bashahr portion of the valley of the Sutlej. Both Persia and Siberia are important sources of amethyst. There seems little doubt that the Mohenjo-daro material was derived from the Deccan Trap.

Slate

Poor slate occurs in the Mānbhūm and Singhbhūm Districts of Bihār and Orissa. Good quality slate is found and worked in the Monghyr District of the same province. Slate of promising quality is known to occur in Baroda, and there are quarries of this rock in Bijāpur (Bombay Presidency). Slate of fair quality occurs in Gwalior. Madras is poor in slate, thin slabs being obtained in the Cuddapah District. Slate occurs in considerable quantity in the Hazāra District, N.W.F. Province, while some of the best slate in India is quarried in the

Panjāb in the Kāngra and Gurgaon Districts. Dehra Dūn and Tehri Garhwāl are slate districts, and the Almorā District of the United Provinces produces large quantities of good slate. The slate of Alwar, Rājputāna, is being worked at the present day.

Slate is not plentiful in Persia. Some of the best known localities seem to be in Māzanderān between Ashraf and Asterābād, and near Kasbek in the Caucasus.

In Afghānistān slates of very fair quality could be obtained in large quantities from between Siāh Sang and Gardān Diwāl on the north side of the Helmand river. Less valuable slate is available north of Jāokal on the left bank of the Helmand river, and also to the east of the Kotal-i-Ūnāī at the head of the Kābul river.

Rājputāna seems to be the nearest locality to Mohenjo-daro from which slate would be available.

Agate, Carnelian, Onyx, and Chalcedony

Agate, carnelian, and onyx are, as LaTouche observes, " of common occurrence in the amygdaloidal flows of the Deccan and Rājmahāl traps, and the chief sources of supply are the rivers that drain the areas covered by these rocks." The beds of the Kistna, Godāvari and Bhīma rivers have been specially noticed in this connection. Agate, jasper, and carnelian are collected from the Godāvari bed near Rājamahendri (17° 0′ : 81° 50′), while many pebbles of agate, onyx, and other forms of chalcedony are found in the Kistna alluvium of the Palnād. The agate employed by the lapidaries of Jubbulpore is largely derived from the Narbadā valley, especially from Bherāghāt or the Marble Rocks. Nodules of agate are found in plenty among the Rājmahāl Hills.

Fine agates and carnelians occur to the north of the Pangong Lake in the Rudok district of Kashmīr.

The most valuable of the veined agate worked into ornaments by the lapidaries of Cambay comes from Rānpur in Ahmadābād. The Kaira district of Bombay has yielded a much prized variety of agate ; landscape agate has also been obtained from this locality. A large vein of moss-agate is to be found at Khijaria in the Morvi State of Kāthiāwār ; common agate occurs in the same neighbourhood. Other localities in Kāthiāwār are known from which moss-agate, common agate, and chalcedony are obtainable.

The chief source from which the carnelian and agate workers of Cambay derive their material is in the Rājpīpla State near the village of Ratanpur (21° 43′ 30″ : 73° 14′ 30″). According to some, the industry has flourished for over 2,000 years.

All the above mentioned localities are close to Mohenjo-daro, and are to be considered as potential sources of agate, moss-agate, and carnelian ; the chances are, however, more in favour of Kāthiāwār and Rājpīpla. Two of the agate beads from Mohenjo-daro, brown and white in colour, resemble the " Pagoda stones " or agates from Burma. Onyx is widely distributed over parts of Nawānagar ; it is especially abundant at Vijarkhi (22° 25′ : 70° 14′ 30″, 2 miles east of Khokhri (22° 23′ 30″ : 70° 28′), near Baolidar (22° 9′ : 70° 13′ 30″), half a mile north-east of Bori (22° 9′ 30″ : 70° 18′), and three-quarters of a mile south of Narmāna (22° 5′ : 70° 13′).

Jasper, Agate-Jasper, and Bloodstone

The rivers draining the Dhārwār and Bijāwar formations all contain pebbles of jasper of a great variety of tints. Conglomerates of material derived from these older rocks supply the rivers which drain the Sātpurā Range in the Central Provinces. The jasper of Mohenjo-daro, therefore, may well have come from Rājputāna. Bloodstone, i.e. green jasper

variegated with red, has been noted as occurring near Tankāra (22° 40′ : 70° 48′ 30″) in Kāthiāwār and in the bed of the Mota Mola river between Fīrozābād and Sindaghi in the District of Agra. It is also found in Rājputāna.

Agate-jasper is mentioned as occurring with common agate in the Rājpīpla Hills, Broach, and the beds of the Kistna, Godāvarī, and Bhīma rivers. The Mohenjo-daro specimens may have come from Rājpīpla or Rājputāna.

Plasma

The bright green and more or less translucent variety of chalcedony known as plasma has been noticed in the beds of the Kistna, Godāvarī, and Bhīma rivers. It seems just as likely, however, to have been obtained from Rājputāna.

Tin

The best known tin locality in Asia is the Malay peninsula, including the Tenasserim Division (Tavoy and Mergui Districts) of Southern Burma. Here cassiterite occurs in considerable quantities, the locality being one of the principal sources of the world's tin.

Cassiterite is also known to occur in the Pālanpur State (Bombay Presidency), and in the Dhārwār District (Bombay), and is reported to have been found in Rewā Kāntha (Nārukot); none of these occurrences has proved of commercial importance. In the Hazāribāgh District of Bihār and Orissa, tin ore is found in more noticeable quantity and unsuccessful attempts to work it have been made.

Tin is known to occur in the Kūh Banān and the Kārā Dāgh in Persia. Tin-stone has been found in five provinces of China—Yünnan, Kwangsi, Hunan, Kwangtung, and Fukien, but deposits of economic importance are restricted to a few areas in the first-named three provinces, the chief producing centre to-day being about 30 miles west of the town of Mengtsze in Yünnan.

It would be difficult to surmise from which of these sources, if any, the tin found in Mohenjo-daro was obtained.

Bitumen

A large deposit of bitumen occurs at Hit on the Euphrates, and was known to the old Babylonians. It is a conspicuous deposit, and must have been known to the earlier Sumerians.

Bitumen is also to be found near Isa Khel on the right bank of the Indus (N.W.F. Province) in India. The quantity is small, but may have been a little greater in olden times.

The nearest bitumen deposits to Mohenjo-daro would be those of Balūchistān. At Khattān (29° 34′ : 68° 31′), in the Marri hills N.E. of Sibi, there is a considerable deposit. Another occurs on the other side of the Sibi plain at Sanni, S.W. of Sibi.

It is difficult to say which of these is more likely to have been the source for the Mohenjo-daro specimens without knowing more about the relationship between that city's civilization and the surrounding regions.

Red Ochre

Red ochre is of wide occurrence in India, especially in Central India and the Central Provinces. In the latter province the deposits of Jauli, Jubbulpore District, are well known

and still exploited. Extensive beds occur in the Kaimur plateau, and many places on the Deccan Trap are characterized by the mineral. Amongst the deposits nearest to Sind are :—

(i) Those of Lakhpat (23° 50′ : 68° 50′) in Cutch.

(ii) Those of Padvānia (21° 41′ : 73° 18′) and elsewhere in the Rewā Kāntha Agency. From Padvānia some 120 tons are said to be carried away annually by Muslim traders.

The red ochre of Hormuz and other Persian Gulf Islands is worth mention on account of its brilliant colour, which must have attracted the very early notice of civilization. Its association with salt and gypsum makes it the more conspicuous, and there is little doubt that it must have acquired a celebrity since very early times. Even to-day it is dug out in large quantities and shipped to India for use as a pigment. Hormuz, Bū Mūsa, and Hālūl are the principal islands from which this material is obtained, and the Mohenjo-daro supplies might well have come by sea from any one or all of them.

Basalt

Basalt is one of the commonest rocks in India and covers a total area exceeding 200,000 square miles in the Bombay Presidency (including Kāthiāwār and Cutch), Hyderābād, Central India, and the Central Provinces. The Mohenjo-daro material might have come from the Kāthiāwār Peninsula, but basalt was even nearer at hand than that, namely in western Sind ; an important band of this rock from 40 to 90 feet thick stretches for about 22 miles from Rānīkot to Jakhwāri, and may well have been used by the ancient inhabitants.

Tachylite

Tachylite is a basaltic or ultra-basaltic glass and frequently accompanies dykes in the Deccan Trap. The specimens found at Mohenjo-daro may have come from any part of the Deccan Trap area, as, for instance, the Kāthiāwār peninsula or Central India.

Nepheline-Sodalite Rock

Amongst the many Mohenjo-daro beads sent to the Geological Survey of India for identification, two are of peculiar interest in that they consist of an uncommon rock—nepheline-sodalite rock—which is found at Kishangarh in Rājputāna. The source of the material, therefore, is almost undoubtedly the neighbourhood of Kishangarh. The present uninteresting dull grey colour of the beads is the result of weathering and the effect of time. Sodalite when fresh is of a beautiful azure blue colour, and the beads, when fresh, must have done credit to their neighbours in jade, agate, jasper, turquoise, etc.

Jadeite [1]

Jadeite, or the hard form of jadestone, of which all the Mohenjo-daro jade beads consist, is found typically in the Myitkyinā district of north Burma, where it has been worked for many years past. The same mineral is reported to occur also in the neighbouring Chinese province of Yünnan, and further north-east in Shensi, but there is some doubt about these reports.

The material from Rewah State in Central India is the nephrite variety. Specimens of jadeite have been described as coming from Tibet ; they probably occur as boulders in alluvial deposits, but the precise locality from which they come is unknown.

[1] See, however, pp. 541–2 *supra*.—[Ed.]

The Aosta valley of the Alps of Piedmont is known to contain jadeite.

The jade from the celebrated mines of the Kārākāsh valley of Turkestān belongs mostly to the nephrite variety, but it is accompanied by some jadeite. In the Pāmīr region jadeite occurs in the valley of the Tunga, a left-bank tributary of the Rāskam Dariā ; this material was once quarried by the Chinese.

Objects of pre-historic age, worked in jadeite, have been frequently found in Europe, Asia, America, and Africa, but in most cases the source of the rough material is unknown.

For the source of the Mohenjo-daro material, therefore, we have the choice of some three localities : the Pāmīrs and Eastern Turkestān, Tibet, or North Burma. If we reject the European Alps as a possible source, the finding of jadeite objects in Mohenjo-daro points with strong probability to communications with Central Asia.

Löllingite

Löllingite is essentially a di-arsenide of iron, $FeAs_2$, but passes into leucopyrite, Fe_3As_4, and frequently tends towards arsenopyrite, FeAsS. Other sulphides of arsenic are : orpiment, As_2S_3, and realgar, AsS. Iron pyrites, FeS_2, sometimes contains arsenic in small amounts ; it will be best, however, to restrict the inquiry to known occurrences of any of the sulphides of arsenic.

In Europe löllingite occurs in the Lölling-Hüttenberg district of Carinthia, and sparingly in a number of other districts ; a sulphur-bearing variety (geyerite) is obtained from Geyer, Saxony. Arsenopyrite is abundant at Freiberg, and at other places in Saxony ; at Andreasberg in the Harz Mountains, Germany ; at Sala, Sweden ; at Skutterud, Norway ; and at several localities in Cornwall. It is also known in the Binnenthal, Switzerland, and as the cobalt-bearing variety (Danaite) at Sulitjelma, Finland. Orpiment is found in Hungary, at Tajowa, Moldova, Kapnik and Felsöbánya, and, with realgar, at Allchar, Macedonia. A large deposit occurs near Julamerk in Kurdistān. Realgar occurs at Felsöbánya, Kapnik, and Nagyag in Hungary, at Allchar in Macedonia, and in the Binnenthal of Switzerland.

The Indian occurrences are as follows :—

(*a*) Sampthar Hill, Darjeeling (arsenical pyrites).

(*b*) Dabur and Dhab in the Hazāribāgh District, Bihār and Orissa ; lumps of leucopyrite are occasionally found in the mica-bearing pegmatites. Recently, leucopyrite was found in the Gamaria mica mine, and löllingite in the Durria mica mine, of the Kodarma Forest area, Hazāribāgh.

(*c*) Barāli, Padar district, in the Bhutna valley, Kashmīr (arsenopyrite).

(*d*) Chitrāl, North-west Frontier Province. Orpiment in the past was imported in considerable quantities from Chitrāl, but the supply has recently diminished.

(*e*) Arsenical pyrites has been mined at Manikaran in the district of Kāngra, Panjāb.

(*f*) On the Dharma and Juwar or Niti Ghats in the Almorā district, United Provinces ("yellow arsenic", i.e. orpiment).

(*g*) Mansiāri, United Provinces Himālaya. Small quantities of orpiment are brought down for sale to the Bagesar Fair.

(*h*) Shankalpa Glacier, United Provinces Himālaya. Fragments of orpiment with a little realgar have been found on the moraine of the Shankalpa glacier.

Arsenic is brought into Kābul from Herāt, but its precise origin is unknown.

In the Caucasus, arsenical pyrites occurs in several localities, which it is unnecessary to enumerate. Orpiment and realgar are also known.

In Asia Minor arsenical pyrites, sometimes gold-bearing, is found in various places east and south-east of Smyrna, up to a distance of about 80 miles.

In Asia Minor, orpiment and realgar are known to occur in several localities, at some of which they are exploited.

In northern Persia, orpiment and realgar occur in the region of the Caspian Sea, in the Kurdistān Mountains in the neighbourhood of Kazvīn, and on the Kaflān-Kūh. These minerals are exported to Turkey.

Most of the above-mentioned localities are possible sources of the Mohenjo-daro material. No reliable conclusions, in fact, can be drawn from the occurrence of löllingite in Mohenjo-daro. Persia, Herāt, Kashmīr, Chitrāl, the Panjāb, Asia Minor, and the Caucasus might, each of them, equally well have supplied arsenic minerals to Mohenjo-daro.

"Green Earth"

The specimen despatched to this department as "glauconite" was found to consist mostly of fine chlorite and calcite. Such material might be found in the Tertiary rocks of Sind itself, but it is far more likely to have been derived from the Deccan Trap. Green earth of this nature was discovered by Dr. Fermor from the basalt of Bhusāwal (*Records, Geological Survey of India*, vol. lviii, pp. 146–7). The Mohenjo-daro sample may have come from zeolitic material filling the vesicles of the trap, or it may represent the more massive form resulting from the alteration of the trap as a whole, which takes place chiefly at the base of a flow. Large masses of this trap occur in Kāthiāwār and Central India, but less extensive tracts occur in Cutch, in the Pab Range of Eastern Balūchistān (Kalāt State), and in the Kākar Range in the extreme north of the same province. It seems very probable that the material was obtained from either north-eastern or eastern Balūchistān.

APPENDIX I

NOTES AND ANALYSES

Ceramic Wares. BRICK, pottery, and miscellaneous terra-cotta objects have been found in abundance at the Indus Valley sites, and it can hardly be doubted that the local alluvial clay was employed for their making. The prevailing colours of these products are light red or salmon; black and grey are uncommon. These colours are due to the presence of iron compounds in the clay, which develop the red shades in the oxidizing atmosphere of the kiln, while black or grey ones are formed when a reducing or smoky atmosphere prevails in the course of burning. The pottery is sometimes covered with a slip of bright red colour, due to ferric oxide; or painted with designs in black or chocolate, which owe their colour to manganese oxide. The identity of the colouring materials with those employed by the Indian potter of the present day, as well as the simplicity of the latter's methods, leaves no doubt that the ancient technique has been handed down to him without any material alteration. He prepares the red slip by levigating red ochre or *Multānī maṭṭī* (a yellow ochreous earth) with water, and employs a manganiferous hæmatite for the black or chocolate shades. The manganese ores which are frequently associated with ferric oxide, impart a pure black colour when rich in manganese, but chocolate, when the proportion of iron preponderates.

A noteworthy variety belonging to this group is represented by a number of fine earthenware bangles, usually black in colour, sometimes mottled white, but all distinguished by their fine vitreous texture.[1] The chemical analysis of one of the black specimens (Table I, p. 689) reveals an unusual composition, containing rather large proportions of lime and magnesia. These ingredients enhance the fusibility of the clay, and therefore account for the vitreous body of the specimens. Their black colour is due to ferrous oxide, which indicates also that the firing took place in a reducing atmosphere. On the other hand, under the oxidizing conditions prevailing in the kiln, the lime and magnesia would bleach the colour due to iron and the product would emerge white instead. The different colours of the bangles can thus be accounted for easily.

Faience. Faience, which was very popular with the Indus people, has a hard, fine granular body, covered with a glaze. The prevailing colours are bluish-green and greenish-blue, although white, chocolate, and red specimens have also been found. The microscopic examination reveals a compact granular structure, composed of angular quartz grains bound together with a transparent cement. Its chemical analysis (Table I, p. 689) shows also that silica is the chief constituent, forming about 90 per cent of the total amount. From these facts it may be inferred that the original paste was composed of finely crushed quartz,

[1] A dark red variety of the earthenware bangles has since been found at Harappā.

or pure white sand, a glassy flux, and a colouring matter, if necessary. It is obvious that the moulded object had to be dried and fired to bring about the fusion of the flux ; but the question how precisely the various ingredients of the paste were endowed with the necessary coherence and plasticity, is difficult to answer. The suggestions that clay or gum might have been employed for this purpose are untenable, as the material is free from clay ; while gum, or any other organic matter, would be consumed in the course of firing long before the flux underwent fusion. Possibly, silicate of soda, which forms a highly viscous solution with water, was employed as a constituent of the paste and served to impart the desired property to the wet paste. It may be added here that the preparation of an alkaline silicate by the fusion of soda with sand, was well known to the ancient nations who practised the art of glazing.[1]

The hollow objects were moulded on cores of sand, which was tied up in some fabric and raked out after firing. Impressions of the fabric, as well as remains of the sandy core, have been found in several specimens.

The white body is free from any metallic colouring matter and forms the basis for the coloured varieties. The blue and green shades were produced by the addition of copper oxide to the paste, probably in the form of a natural ore of this metal ; and the chocolate colour is due to cuprous oxide, which was the result of a reducing atmosphere in the kiln. The light red variety was prepared by the addition of red ochre to the raw paste.

To form some idea of the brilliant effect of these objects, due allowance should be made for the changes produced on them by the corrosive action of the alkaline soil in which they were so long buried. As a fact, the original glaze has survived on very few specimens, although the body material is generally well preserved. In some cases the decomposition has penetrated deeper, changing the blue or green colour into dull white or brown, which have resulted from the bleaching out of copper oxide and the precipitation of basic carbonate of iron, respectively.

Steatite Faience. The body material of this peculiar class of ware is powdered steatite, which is bound together with a flux. Originally objects of this material must have been glazed, but they have undergone much decomposition, and not a vestige of the glaze has been left on them. The material is soft and cream white ; but the presence of a little copper oxide in it, revealed by chemical analysis (Table I, p. 689), leaves no doubt that they were originally coloured blue or green, like ordinary faience. In fact, it is highly probable that their whole technique was identical with that of the faience described above, and that steatite was introduced to replace quartz, in order perhaps to get over the difficulty experienced in crushing this very hard mineral.

Glaze. Faience objects are covered with a distinct layer of glaze which must have been applied separately, as in the case of the steatite objects. It is highly probable that the glazing process was carried out in the second firing, as at present. The prevailing colours of the faience glaze are bluish-green or greenish-blue, although indigo blue, apple green, maroon, black, and colourless examples have also been found. The blue shades owe their colour to copper oxide, while the green contains iron oxide, in addition. The black or dark maroon glaze contains an excess of manganese oxide. It has been remarked already that the glaze has perished mostly through decomposition, and the material available is scanty for a complete chemical analysis. However, judging from its transparency, the nature of the colouring matter, and the iridescent films on these objects, one can safely conclude that it is of the nature of glass. Ancient specimens of glass consist of silicates of soda and lime and a metallic oxide for the colour, besides certain impurities derived from the raw materials. They were prepared by the fusion of an alkali, sand, saltpetre, and chalk, with a metallic oxide for the coloured varieties.[2] All

[1] Campbell Thompson, *The Chemistry of the Ancient Assyrians.*
[2] *Ibid.*

these ingredients were easily available to the Indus people, and were doubtless utilized for the art of glazing. For instance, alkaline efflorescences, which cover wide areas of soil in Upper India, could have been employed for this purpose. We shall see, too, that there is some possibility of silicate of soda (a water-soluble glass which is formed by the fusion of soda and quartz powder) having been used as a medium to produce the white slip on steatite seals. Taking all these facts into consideration, we are led to the conclusion that the glaze was produced by the simple methods indicated above, which were followed by the Assyrians down to the seventh century B.C.

Steatite. Steatite is an impure massive variety of talc, containing 4–8 per cent of combined water. It is one of the softest minerals with a soapy feel ; but at red heat it loses the water and is transformed into a very hard, white substance which can be polished.

The Indus Valley people were well acquainted with this property of steatite and made good use of it. The stone lent itself readily to carving with the aid of their bronze tools, and the finished product could be rendered hard and durable by careful ignition. The results of the chemical analyses (Table I, p. 689) leave no doubt that the material is steatite, which has been deprived of most of its combined water at a high temperature. Beads of various shapes were fashioned in large numbers out of steatite ; but the largest piece of carved steatite is the statue illustrated in Plate XCVIII. The most important objects in this class, however, are the numerous inscribed seals which are finished with an exquisite white enamel-like surface.

Generally these seals bear evidence of strong ignition, containing only 1–3 per cent of water ; but some have the characteristic soapy feel of ordinary unburnt steatite, with over 4 per cent of water. This fact has an important bearing on the problem of the technique of the white coating, as it leads to the definite conclusion that a high temperature was not essential for this process. Therefore, it is not in the nature of a glaze or enamel formed by fusion above red heat. It is curious that its composition (Table I, p. 689) conforms also to that of steatite, which is clearly its principal constituent. From these facts it may be inferred that this coating is a slip which was prepared by levigating steatite in water, with a suitable medium to serve as a cement. Regarding the nature of this medium, it must be borne in mind that the coating or slip, on these seals, is generally very well preserved, which should preclude the possibility of a gum or any other perishable organic substance. The writer has carried out various experiments in order to arrive at a solution of this interesting problem, and has found that durable coatings, similar to those on the seals, can be produced with a slip prepared by levigating ignited steatite in water with silicate of soda as the medium. After the application of the slip the object was dried in the oven at 100° C. and polished with agate. It is highly probable that a similar method was followed by the Indus people.

Steatite objects with well preserved glaze are rare ; but a careful search with the aid of a lens sometimes reveals traces of a green glaze. It is evident, therefore, that some of the objects (e.g. round and oblong beads) were originally glazed. The red paint on some of these objects consists of ferric oxide ; for this yellow ochre appears to have been employed, which acquires a fine red colour after ignition at a moderate heat.

Mortar. Analyses of the specimens of mortar found at Mohenjo-daro (Table II, p. 689) make it clear that pure gypsum and lime mortars, as well as their mixtures, were employed.

Pigments. The pigments found on polychrome and painted pottery are black, white, red, yellow, and green. The black is carbon, which indicates lamp-black or ground charcoal. The white is a mixture of calcium sulphate and carbonate, which implies gypsum and lime. The red and yellow are the well-known ochres, which are widely distributed in Upper India. Specimens of the refined pigments have been found also in the form of small tablets and in tiny capsules.

The green is free from copper, owing its colour to an iron silicate, indicating *terre verte*. Lumps of a green earth which occurs in cavities in the Deccan Trap, have been found at Mohenjo-daro, and it is very probable that this material was employed as pigment, after necessary purification.

TABLE I.—CHEMICAL ANALYSES OF CERAMIC MATERIALS FOUND AT MOHENJO-DARO

	Specimen.	Silica.	Alumina.	Ferric oxide.	Ferrous oxide.	Manganese oxide.	Lime.	Magnesia.	Alkalies.	Copper oxide.	Water.	Analyst.
1.	Black bangle . .	54·28	19·63	—	8·70	0·13	9·63	4·39	3·43	—	—	Mohd. Sana Ullah
2.	Greenish pottery .	52·39	17·03	5·30	2·29	—	15·78	4·45	1·71	—	1·05	do.
3.	Faience vase (bluish-green).	89·76	3·86	0·93	—	—	0·88	tr.	4·07	0·50	—	do.
4.	Faience bangle (bluish-green).	88·12	3·02	1·82	—	—	1·26	—	Na_2O, 4·50 K_2O, 0·65	0·46	—	do.
5.	Faience tubular bead (chocolate).	91·07	2·44	1·15	—	tr.	1·28	tr.	2·08	Cu_2O, 1·98	—	do.
6.	Steatite } Disc. .	57·99	4·85		—	—	4·31	27·20	3·54	1·09	2·01	Dr. M. A. Hamid
7.	Faience } Statuette .	57·23	3·69		—	—	6·39	28·99	1·88	0·46	1·36	do.
8.	Slip from steatite seal	61·2	2·4		—	—	—	34·6	—	—	1·8	Mohd. Sana Ullah
9.	Steatite flat beads .	63·65	—	—	—	—	—	33·80	—	—	1·09	do.

TABLE II.—MORTARS

Locality.	Gypsum.	Carbonate of lime.	Sand.	Alkaline salts.	Moisture.	Analyst.
Wall (HR Site)	74·12	2·50	20·41	1·18	1·79	Mohd. Sana Ullah
do.	63·25	0·66	31·61	3·47	1·01	do.
Tank (SD Site)	43·75	13·78	38·04	2·47	1·96	do.
Drain (DM Site)	56·73	24·87	16·64	—	1·76	do.
Vat (HR Site)	nil	69·58	21·71	5·44	3·27	Dr. M. A. Hamid
Drain and Cesspit (DK Site)	nil	39·96 Magnesium Carbonate 8·82	46·74	0·74	3·74	Mohd. Sana Ullah

Śilājit.

A black coal-like substance found at Mohenjo-daro has been identified by the writer as *śilājit* or *shilājātu*, an ancient Indian medicine. It occurs as an exudation on rocks in the Himālayas, and is popular with the physicians following the old school. Charaka says that " there is hardly any curable disease which cannot be controlled or cured with the aid of

Shilājātu". The composition of the Mohenjo-daro specimen (M) is shown against those of four specimens analysed by Hooper (*JASB.* 72 (1903), 98–103) in the table below :—

Analysis of Śilājīt

	M.	I.	II.	III.	IV.
Water	15·99	9·85	15·90	11·15	10·99
Organic matter	55·24	55·20	49·86	51·55	56·86
Ash	28·77	34·95	34·24	37·30	32·15
	100·00	100·00	100·00	100·00	100·00
Ash :—					
Silica	8·23	1·35	1·62	18·10	10·15
Alumina	2·43	2·24	1·08	6·00	4·64
Ferric oxide	1·44				
Lime	7·31	4·36	3·96	3·86	3·88
Magnesia	0·32	1·50	0·52	0·15	1·34
Alkalies	9·04	13·18	14·32	4·78	6·91
Carbonic acid, etc.	not determined	11·51	12·13	3·69	4·83

(Analysis of M. by Dr. Hamid.)

Löllingite.

Specimens of löllingite or leucopyrite also deserve special mention as they bear evidence of having undergone ignition. Under the action of strong heat, these minerals give off arsenic ; or its white oxide, when roasted in air. It is, therefore, highly probable that these minerals were employed for making arsenious preparations, either for medicinal purposes or for destroying life. The fatal properties of arsenic compounds evidently attracted attention very early. The red and yellow sulphides of arsenic have been mentioned by Aristotle, Theophrastos, Dioscorides, and Pliny, as well as in ancient Sanskrit medical works. Bergman in his *De Arsenico* said: "It is probable that arsenic was first discovered by those who wrought in the roasting and fusing of ores, for it would betray itself by its white smoke, its garlic smell, and its pernicious effects in depraving metals and destroying life." It has been shown by the writer in another section of this work that the Indus people were metallurgists of considerable experience and ability and were using also an alloy of copper and arsenic for their tools. It is obvious that they were well-acquainted with the working of arsenical ores of copper which would give off fumes of white oxide of arsenic on roasting. It is, therefore, quite conceivable that they had become acquainted with certain arsenical preparations and their properties, and utilized löllingite or leucopyrite for the extraction of arsenic.[1]

The composition of a natural löllingite specimen (B) is given in the table below along with those from the Indus Valley sites. It is obvious that the latter are very poor in arsenic, which is due to the effect of the heat to which they have been subjected. It is difficult to suggest whether löllingite, $FeAs_2$, or leucopyrite, Fe_3As_4, was employed.

Analyses of Löllingite

	B.	I.	II.	III.	IV.	V.
Iron	27·14	54·55	49·3	45·63	51·7	48·1
Arsenic	72·17	34·02	43·6	47·12	43·9	48·6
Copper	—	0·92	0·7	—	—	—
Sulphur	0·37	1·38	0·16	—	—	—
Water	—	7·68	4·7	—	—	—
Insol.	—	1·45	0·8	—	—	1·9
Sp. gr.	—	4·0	5·6	—	—	—

(Analysis of the natural specimen (B.) is by Brevik and those of the Indus specimens by the writer.)

[1] For the possible sources of löllingite and leucopyrite, see pp. 684–5 *supra*.—[Ed.]

Cerussite and Cinnabar.

The use of cerussite (a natural carbonate of lead) and cinnabar (sulphide of mercury), which have also been discovered at Mohenjo-daro, is difficult to understand. It is doubtful if they were employed as pigments, as the analyses of the colours on polychrome pottery do not support this view. Possibly they were utilized for cosmetics or medicinal purposes.[1] In this connection it may be mentioned that white lead was employed for plasters, eye salves, and hair washes in early times. Cinnabar may also have served as a medicine, but it is more probable that it was employed for the extraction of mercury.[2] This metal was known to the ancient Egyptians, and a small vessel full of it was discovered by Schliemann in a grave at Kurna, belonging to the sixteenth or fifteenth century B.C.

Galena was very probably used for the preparation of eye salves or paints.

[1] A small faience flask containing cerussite powder has been found at Harappā.

[2] For the confusion in Roman times between red sulphide of mercury and the other cinnabar which was the exudation of a dracæna, see Schoff, *The Periplus of the Erythræan Sea*, pp. 137–9.—[ED.]

APPENDIX II

NOTE ON GLAZED POTTERY

THE fragments of pottery submitted to me bear a design in a series of parallel waves of a milky hue which have the appearance of being on a deep purplish-black ground. The surface is extremely thin, and to a certain extent contaminated with sand and mica. For this reason physical tests are more likely to be reliable than chemical analysis in ascertaining the true nature of the surface.

MICROSCOPIC EXAMINATION AND HARDNESS

(1) Evidence is here adduced that the milky striations are, in fact, glaze, while the dark groundwork is essentially non-vitreous.
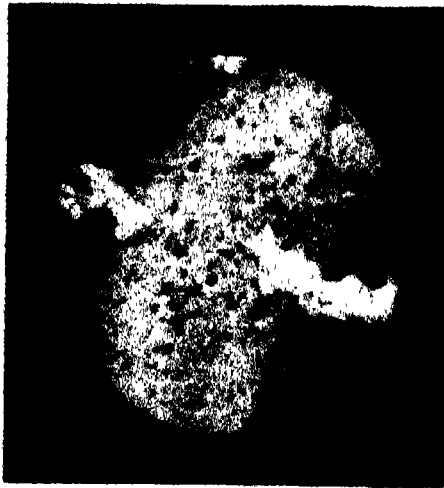
FIG. 40.—Microphotograph of glazed pottery, showing scratch.

FIG. 41.—Microphotograph of glazed pottery, showing fracture of glaze.

(*a*) Scratch tests show the groundwork to have a hardness less than 5 (Moh's Scale of Hardness), whereas the milky portions are decidedly harder and correspond with 6, the figure required by glass and glaze.

(*b*) The microphotograph in Fig. 40 (× 20 diams.) shows a scratch made by lightly drawing a needle transversely over one of the milky lines. It will be noted that the needle has scratched the groundwork but has not affected the milky portion. The same photograph clearly shows blow-holes in the surface of the milky line, indicating that it has at one time been in a state of fusion.

(*c*) The microphotograph in Fig. 41 (× 30 diams.) shows a break in the glaze, and the conchoidal fracture is characteristic.

(2) Certain further observations may help to explain the thinness of the surface and to give some indication of the technique of manufacture.

(*a*) A broad examination of the surface suggests that it has been rubbed down or burnished with a stone before firing, and microscopic examination tends to confirm this as regards the groundwork but *not* as regards the glaze. If the surface has been burnished, it seems certain that this has been done prior to glazing.

(*b*) Under a high power certain lines are noticed which for convenience we may refer to as "stream-lines". These stream-lines are noticed particularly along the groundwork, and they follow the lines of the glaze. Ref. Fig. 40, where a dark curved line will be seen near the edge ; this line is, in reality, a part of the stream-line.

(*c*) The groundwork is almost, but not entirely, free from vitreous matter.

It is suggested that, after modelling, the pot was coated with a colouring clay, which was burnished into the surface with a blunt instrument. The surface was then dipped or painted with a slip, which may have been made from powdered slag, and sun-dried. The pattern was obtained by removing the slip in a regular fashion with the aid of a comb-like instrument, and the pot was then fired. From the appearance of the body, which is hard and white and contains traces of translucent material, it would seem that the firing has been conducted at a fairly high temperature.

TABLE OF MEASURES WITH METRIC EQUIVALENTS

Measure	Equivalent	Measure	Equivalent
·1 inch	= 2·54 millimetres	5 inches	= 12·70 centimetres
·2 „	= 5·08 „	6 „	= 15·24 „
·3 „	= 7·62 „	7 „	= 17·78 „
·4 „	= 1·01 centimetres	8 „	= 20·32 „
·5 „	= 1·27 „	9 „	= 22·86 „
·6 „	= 1·52 „	10 „	= 25·40 „
·7 „	= 1·77 „	11 „	= 27·94 „
·8 „	= 2·03 „	1 foot (= 12 inches)	= 30·48 „
·9 „	= 2·25 „	3 feet (= 1 yard)	= ·91 metres
1 „	= 2·54 „	10 „	= 3·04 „
1·1 inches	= 2·79 „	20 „	= 6·09 „
1·2 „	= 3·04 „	50 „	= 15·24 „
1·3 „	= 3·3 „	100 „	= 30·48 „
1·4 „	= 3·55 „	200 „	= 60·96 „
1·5 „	= 3·81 „	500 „	= 152·40 „
2 „	= 5·08 „	1 furlong (= 220 yd.)	= 201·16 „
3 „	= 7·62 „	1 mile	= 1·609 kilometres
4 „	= 10·16 „	1 acre	= ·405 hectares

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* The letters A, B, C, D, and E refer to original trial trenches in the DK Area, some of which disappeared when the digging was subsequently expanded.—[ED.]

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Faience Vessels

Figurines

Pottery

L Area